SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol XXXIV.—No. 4. [NEW SERIES.] NEW YORK, JANUARY 22, 1876. [$3.20 per Annum. [POSTAGE PREPAID.]

NEW RAILROAD DEPOT.

We present herewith a view and a plan [see page 51] of the depot recently erected at Worcester, Mass., for the joint use of the Boston and Albany, the Norwich and Worcester, and the Providence and Worcester Railroads. The design, as will be seen in our engraving, is picturesque and effective, and the work is remarkably solid and substantial. We extract the following particulars from the Worcester *Gazette:*

"In the center of the front is the main passenger entrance to the building. About 15 feet from the entrance, and directly in front, is a granite archway supported by double columns of granite. This is connected with the round part by a trussed roof, making three archways. The two at the sides are to be used as a driveway, thus enabling passengers to arrive and depart at all times without being exposed to the weather. On the outside of the round part a stationary awning has been built, which will cover a walk 10 feet wide, which is to be built under it. At the northwest corner of the building is a stone tower, the cap stone of which is 159½ feet from the ground. Above this rises a wooden extension covered with slate, 40 feet in hight, and surmounted with a rod and vane of 13 feet, making a total of 212½ feet. In the construction of the stone work of the building and tower, there were used 600,000 brick, 12,000 tuns of stone, and 3,000 barrels of lime and cement. Near the top of the stone work of the tower a large clock room has been built. It has not yet been decided what kind of a clock will be placed in it. A strong effort is being made to have one with an illuminated dial.

"The roofs of the two sections are each supported by eight heavy trusses one end resting on the walls of the building, the other on the girders running over the heavy iron pillars placed through the center of the building. These two roofs are covered with slate, except a part of the two sides where they join in the center of the building. Over this part of the roof there has been built a second roof which begins at the east and west ends of the building where it is about 3 feet wide, and ascends with a gentle slope to the center of the building, where it is about one third the width of the building covered by the two roofs. This roof is made of concrete, and is built to catch the snow from the inner slopes of the two roofs, which would, but for this, slide down to the bottom of the pitch The two roofs are surmounted with ventilators running the entire length of each. On the top of each is an ornamental iron railing, while over the top of each arch is a large vane. The roofs of the ventilators are covered with 7,200 panes of glass, 12 by 34 inches in size, set in 360 sashes."

The offices and waiting rooms are conveniently and handsomely fitted up, and the whole work reflects credit on the architects, Messrs. Ware and Van Brunt, of Boston, Mass. These gentleman, and Mr. E. S. Philbrick, the engineer, have done their work under some difficulty, as the uniformity of their design has been broken by the arrangement of the side entrance for the Boston, Barre, and Gardner and the Nashua and Worcester Railroads. The *Railroad Gazette,* from whose pages we select the engravings, is our authority for stating that this unfortunate arrangement is due to the managers of these two railroads, who declined to accede to any other plan.

"Composito" Vessels for the Coast Survey.

There was recently launched at Baltimore, for the United States Coast Survey, a "composito" vessel—that is, a vessel built partly of iron and partly of wood. It appears that this vessel was built upon recommendation of Captain Patterson, of the Coast Survey, whose views on the subject are of interest in adding to our knowledge of the important questions affecting the shipbuilding trade. He says that experience has shown composito vessels to be more economical and more durable than vessels built either entirely of iron or entirely of wood, and that this is more especially the case in our Southern waters. In the composito hull, the frame and beams are of iron, and the planking of wood The waters of the Southern coast are found to seriously affect iron hulls, so that after about sight years the iron fails. Five or six years ago two small composito vessels were built for the Coast Survey, in Baltimore, and they have proved very successful; one of these, the Bibb, withstood the terrible cyclone which recently destroyed Indianola. She was subject to its full severity for ninety hours, but passed through it unscathed. In the period of nearly six years that they have been afloat, the repairs to these two schooners have not exceeded $600. Subsequently another composito schooner of 125 tuns was built, and afterwards a composito steamer of 200 tuns. Captain Patterson thinks that this class of vessels will in time be generally used, on account of their much greater durability than wooden vessels, which much more than balances the somewhat heavier first cost.

Spontaneous Centennial Celebrations.

There is considerable significance in the hearty welcome about to be given in big and little towns all over the country to the Centennial year. Preparations are making in scores of cities, villages and hamlets for illuminations, processions, salutes, and other appropriate ceremonies, and we have yet to hear of one in which there has been the smallest difficulty as to the collection of necessary funds.

It is evident that the people everywhere are ready to second efforts for voluntary and spontaneous Centennial ceremonies; so evident, indeed, that Congress can do the international exhibition no greater service than by declaring on the day of their reassembling that the exercises at Philadelphia shall be voluntary and not perfunctory. When Congress shall have said distinctly that no appropriation of government money shall be made to the exhibition, the people will not be slow to contribute every dollar needed for the proper conduct of the enterprise. So long, however, as the commissioners shall depend upon a government subsidy, they can expect little from the spontaneous enthusiasm of the people. This element of spontaneity is essential to the highest success of the exhibition, and there could be no surer way of destroying it than that for which the direct sponsors of the exhibition are mistakenly praying.—*New York Evening Post.*

THE UNION RAILROAD DEPOT WORCESTER MASS

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year, postage included.....$3 20
One copy, six months, postage included..... 1 60

Club Rates.

Ten copies, one year, each $2 70, postage included.....$27 00
Over ten copies, same rate each, postage included..... 2 70

☞ By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise the paper will be sent from the receipt of the order. When requested, the numbers can be supplied from January 1st, when the volume commenced. In case of changing residence, state former address, as well as give the new one. No changes can be made unless the former address is given.

If any of our readers fail to receive their numbers regularly; if the direction is not plainly written; if premiums are not received; or if there is fault of any sort at this office, we will thank our friends to send us posta card complaints, and repeat the same, if need be, until the remedy is effected. *Do not hesitate to complain.* We desire to keep all matters between ourselves and patrons right and satisfactory.

VOLUME XXXIV., No. 4. [NEW SERIES.] *Thirty-first Year.*

NEW YORK, SATURDAY, JANUARY 22, 1876.

Contents.

(Illustrated articles are marked with an asterisk.)

THE SCIENTIFIC AMERICAN SUPPLEMENT.
No. 4.
For the Week ending January 22, 1876.

TABLE OF CONTENTS.

WORKING MEN'S VISITS TO THE CENTENNIAL.

According to present indications, the cost of living in Philadelphia during the Centennial is going to be high. It is but natural that the citizens will avail themselves of the golden opportunity offered by the immense influx of transient visitors, and hold temporary accomodations at prices which will severely tax the average purse. While this state of affairs may not work as a hindrance to the visits of those living within a moderate distance of Philadelphia, and who will therefore avoid heavy traveling expenses, it doubtless will be the means of keeping away a large number of others residing in more distant parts of the country, and especially working men, who will probably be the most appreciative visitors but whose funds to spare for the occasion will be closely limited. It seems to us that, of all classes which, it is expected, will be benefited by the Exposition, the working men stand first. We do not believe that any intelligent workman can examine the display without being improved thereby, and that even the dullest individual will leave the grounds with his ideas widened and with some useful knowledge of the skill and progress of others, in at least his own trade.

The tendency of the present time is to dignify labor, to convince men that to work is not degrading, and that the educated worker with hands is the peer of the educated worker with brains. Mr. Gladstone in a recent admirable address on Science and Art, says to working men: "Blend the beautiful with the useful, and the distinction between what is manual and what is mental will be lost, to the manifest gain of your class, to the unspeakable benefit of all." "Ennoble your work, and it will ennoble you" is the translation of the above into shorter terms: but to ennoble or improve work without education is impossible; and in that subtle and most effective form of education which instructs by arousing the desire to strive and do likewise, the education afforded by the museum of art, and the exposition of other men's consummate skill, this country has been sadly lacking. With the Centennial, however, begins our greatest attempt to supply this need, and by the Centennial is offered to working men of every class such an opportunity to study and to emulate as no other exposition heretofore held has ever paralleled, even in point of magnitude. We need not argue further to show that what elevates and raises the working men likewise affects the whole community, and that, by benefiting the one, we indirectly, though none the less surely, benefit the other.

To come back to the practical side of the subject, it must be admitted that, if excessive prices at Philadelphia are going to act as a prohibition to working men visiting the exposition, and thus act as a bar to their acquiring the benefits referred to, then it is not only in the interest of the men themselves, but of those who directly gain by the work, to devise means of avoiding unnecessary expenses. And here we think is an opportunity for the unions and trade societies to come forward and benefit their members. Some of the unions have large and influential memberships and possess considerable funds. A small tax would greatly augment the latter, and perhaps in this way a sum could be raised to put up and maintain buildings especially devoted to working men's accommodation. These edifices need be but temporary structures on rented ground, and the charges for occupying them should be but slightly above actual cost of maintenance. If the large unions would each erect their own structures, and the small ones club together and build, all the trades would be represented, and working men of all classes would be provided for. For non-union men a slight extra charge, equal to the tax imposed on the society men, might be made, and thus in the end the unions, besides benefiting all workmen, would profit pecuniarily by the operation.

It would be a wise plan for large employers and societies to confer with railroads and other transportation companies, and arrange special rates for transporting working men at prices below the reduced excursion tariff offered to the general public, and to issue special working men's tickets, to be bought through employers and societies. In the same way the unions or any association of individuals may erect workmen's accommodations and issue tickets for a certain number of days' board and lodging.

As regards the action of employers themselves, we presume that nearly all will see the benefit of affording their men as much opportunity as possible to visit the Centennial. Where it is out of the question to afford holidays sufficient for all to go, the privilege might be granted to the most deserving, or held out as a reward for special effort. It might be well for those who approve such a course to notify their men now that the two workmen in each department of the works, for example, who should show the best record for attention to duty, etc., between the present time and, say, July 1, would then be furnished with tickets to and from Philadelphia, and lodging tickets while there, and given as many holidays as the employer might fix upon. A report from these men might be requested on their return, or they might be given to understand that each would be desired to explain before his comrades whatever he had seen of interest in their especial branch of trade. Another suggestion we have to make is that an employer should, when he is likewise an exhibitor, and displays some object which, like an engine or steam pump, requires attention and care, instead of keeping one man at that duty, if it be anywise possible, send a different one from the works every week, or every three days. In this way a large number of working men may see the Exposition without the employer's incurring any considerable expense.

THEORY AND PRACTICE.

We published an article on page 8 of our current volume, in which we showed how the results obtained in practice, in regard to the effects of expansion of iron in bridges, did not agree with those of the theoretical calculations; and this is only one instance in which theory and practice appear to disagree. Some persons go so far as to assert that they never agree, while others even say that they cannot agree. We, however, maintain that they must invariably accord, and that, if this is not apparent, the practice is defective or the theory incomplete. This opinion is founded on an experience of many years, by carefully investigating all cases where such disagreement appeared to exist; and our faith in theory has proved to be well founded in every case in which the theory was complete, and the practice, if not perfect, at least of such a nature that the imperfections could be ascertained.

A case wherein an incomplete theory was taken as the basis of a calculation is found in the article already mentioned, in regard to the effects of expansion of the iron in bridges. The data, on which the theoretical calculations was founded, were obtained from experiments concerning the expansion of metals by heat while the specimens were not under compression, and their contraction by cold when not under strain by extension. In order to use such data as the base for calculating the effects of expansion and contraction in iron structures, it will be necessary that the experiments be repeated, and new coefficients of expansion and contraction be obtained by experiments in heating and cooling metals while under great strain; in this way we may ultimately ascertain the law which modifies the figures now in use, which must be varied according to the compression or extension which is brought to bear on the expanding or contracting metals. Notwithstanding that this expansion and contraction are exceedingly powerful and able to overcome very great resistances, it cannot be maintained that such resistances are without any influence on the amount of expansion and contraction, and it is for the determination of these amounts, for different degrees of resistance, that new experiments are required. This is only a single instance of the great work which yet has to be done by engineers in settling the data for calculations as to the strength of materials, calculations on which depend the success, scientific as well as economical, of the labors of the many great men in the profession of civil engineering.

DRAWBRIDGE INCONSISTENCY.

It has always seemed to us that no one could stand by the great bridges which span the Hudson river at Albany, and witness the immense fabrics slowly swing their huge draws open to admit the passage of some puffing little tug not a hundredth part of the size of the whole structure, without being struck with the incongruity, if not absurdity, of the proceeding. A passenger train may be delayed on each bank of the river, and crossers innumerable may wait as patiently as they may on each approach of the bridge: all this is of less consequence than the passage of a tow of slow canal boats, or of some solitary sloop or schooner. The Albany bridges are, however, but a sample of drawbridges in general, and the question why draws should exist in a great number of instances, or why should vessels have the right of way, applies to the entire class. Once upon a time, when railroads were not, and the principal traffic of mankind was done by water, it was important that the path of vessels carrying on commerce should not be barred. Public policy gave them a right of way over the stage coach, and bid the latter wait until the more important conveyance had passed. The law recognized this, and courts in their decisions wisely sustained the law in its strict interpretation. But as the times changed the law did not, and justice, proverbially blindfold, was especially so in this regard, and entirely failed to perceive that the railroad had supplanted not merely the stage coach, but the freight vessels as well, and that rapid transportation was and has been for some time past the last thing expected by those who ship their goods *via* river schooner or canal. Consequently justice or law has stupidly persisted in making the railroad train at forty miles an hour give way to the sailing craft at four knots, that is to say, cars loaded with perishable freight perhaps, or impatient passengers to whom time is money, or the fast mails of the public, must stand a longer or shorter time on the brink of a river and wait the passage of a schooner load of brick or lumber. Why? If there be any sound reason for the preference, we confess our inability to perceive it.

Nor is this all. Although it presumably may be supposed that, for the protection of their own property, railroad companies will avail themselves of the most approved means of avoiding disaster and accidents, the fact nevertheless remains that, despite such means especially adapted to warning trains approaching drawbridges, trains have run headlong into the open gulf again and again. On most roads engineers are cautioned to bring their locomotives to a full stop at a certain point just before reaching the bridge; but here is delay again, coupled with the probability of the rule, like every other based on human fidelity or prudence, being slighted or neglected.

If a bridge barred a great harbor, like that of New York for example, or even a less port, where the commerce by water was of major importance, it would be wise to give vessels the right of way; but such a condition of affairs practically negatives the existence of a bridge as a means of crossing, since the repeated interruptions to travel would speedily cause a resort to tunneling or other means, as a cheaper and far more convenient alternative. It is, therefore, very rarely that we find the railroads blocked by drawbridges for really important causes. In the case of Albany, no ocean vessels ascend so far up the river, and nothing larger than the regular river steamers for Troy have occasion to go under the bridges. On scores of railroads, there are draws which serve no more useful purpose than the admission of a chance schooner into some short arm or inlet. It would be a much better policy to abolish drawbridges altogether wherever the condition of affairs is such that a steamer by knocking down her funnel, or sailing vessels by lowering their upper masts, can pass under: or else to alter the laws to conform to those now in existence in Holland, which forbid any vessel approaching a drawbridge when a train is due. It is a very easy matter to house topgallant masts in large ships, or to lower topmasts in a fore-and-after; as for dropping funnels, it is done, by every penny steamer that plies along the Thames at London, dozens of times daily. Bridges without draws

moreover, are very much cheaper to build and maintain than those with them; and in cases where the draw is unavoidable, it is very much easier to signal and warn off a slow sailing vessel, or even a steamer, than a lightning express train.

THE CENTENNIAL EXHIBITION.

"The prospects of the Philadelphia Exhibition are so gloomy just now that its friends are filled with alarm. Every effort has been made to stimulate the people of the United States to enthusiasm in its favor, but there is a very widespread feeling across the Atlantic that exhibitions are a nuisance; and the requisite funds cannot be obtained for the completion of the undertaking from a people who refuse to respond to the most pressing invitations for subscription. As a last resource, the Exhibition promoters are going to Congress for a vote of $1,500,000, or, say, £300,000. The applicants state very plainly that it is their last resort, having failed to get what they need from the people directly, and that without this aid their enterprise may be limited and delayed. There appears thus far to be no party feeling upon this measure, and probably there will be none. The want of money is, moreover, not the only trouble in store for the management.

It will be remembered that foreigners refused to send their goods to America, unless they were permitted to affix the prices at which they could be sold if admitted duty free. This point was conceded without much opposition at the time, but the native manufacturers now find that they cannot possibly compete with foreigners in price, and they are now beginning to utter indignant protests against the publication of any prices. In a word, the protectionists are afraid that the people of the United States will learn so much at the Exhibition that they will rise *en masse* and crush the party. Already it is rumored that, if the price rule is adhered to, many of the leading houses in the States will not exhibit, while, on the other hand, if the rule is broken, foreigners will not put in an appearance. Altogether things do not look well for the Centennial; and if we may be allowed to use an expressive Yankeeism, it is not impossible that the whole thing may end in a gigantic 'fizzle' after all."—*The Engineer.*

Our esteemed cotemporary is evidently not posted in respect to the "hard pan" of the Exposition. He does not realize that all the buildings are nearly done, that all will be ready before they are actually wanted, that all the arrangements are complete to ensure the success of the Exhibition, and that there is not the remotest possibility of its becoming a "great fizzle."

The Exhibition Company has, it is true, applied to Congress for a grant of $1,500,000, which, if allowed, will be a convenient plum for the managers, ought to augment the greatness of the affair, and add to its renown. But whether the payment is granted or denied will not materially affect the fact of the success of the Exhibition, since that is already assured.

In applying for this grant, it has been necessary, we presume—it is always necessary in such cases—to make use of a little special pleading. Our cotemporary has probably allowed his ideas of the state of the enterprise to be more affected by this pleading than by the astonishing magnitude of the works and labors that have been actually realized, and which, as stated, place the final success of the Exhibition beyond question.

We regret that our British friends have thought it unadvisable to take any very prominent part as exhibitors; but we feel sure that they will flock here in thousands as visitors, and we shall welcome them most cordially. We hope to surprise them by the extent and extraordinary novelty of the display. If good old England is not a great contributor, her people, when they come, will find that her descendants have not been lacking, and that they have appreciated the glorious industrial lessons which she taught them in 1851.

BAMBOO AS A SOURCE OF PAPER STOCK.

The steadily increasing demand for fiber for papermaking has driven our manufacturers to the ends of the earth in search of new fibers. Not a few have looked with longing eyes upon the wealth of raw material going to waste, the world over, in bamboo thickets; and many attempts have been made to convert such fiber economically into paper stock.

Mr. Thomas Routledge, a progressive papermaker, claims that the slow progress made with this plant has been due not to any inherent unfitness of the bamboo, but to the fact that insufficient attention has been paid to age of material used.

Like the asparagus plant, the bamboo is succulent and tender when young, but rapidly becomes hard and woody with age. When mature, it is, as all know, exceedingly dense, and in most varieties the outer part is so hard and silicious that it will strike fire like flint. To convert stems at this stage into pulp, they must be subjected to long-continued boiling in strong solutions of caustic alkali, at high temperature, under a pressure of ten or eleven atmospheres; a process at once difficult, costly, and dangerous.

Mr. Routledge finds that these objections may be obviated, and the bamboo made to furnished excellent fiber cheaply, simply by using the plant when young and green. Before the stems become indurated and woody, a very mild treatment of alkaline baths, at atmospheric pressure, suffices to dissolve the mucilaginous and extractive compounds combined with the tissues, so that the fibers may be readily separated pure and free.

For many years Mr. Routledge has devoted much time to the investigation of new fibers for papermaking, testing both chemically and practically as a papermaker nearly every known fibrous material; and he does not hesitate to say that no other fiber can approach the bamboo in economy of production, and very few if any in the quality of the stock it yields for the manufacture of paper. And it has the further advantage of being practically inexhaustible in quantity. The bamboo is of extremely rapid growth, and it flourishes in every tropical country. Grown under favorable conditions of climate and soil, it excels every other plant in amount of available fiber to the acre, and there is no plant which requires so little care for its cultivation and continuous production. The estimated yield is twenty times that of flax, hemp, jute, or cotton.

In view of the threatened exhaustion of the supply of esparto, owing to the greed of the native collectors, the utilization of the bamboo promises to be a great public advantage, even if the paper produced from it falls far short of Mr. Routledge's anticipations. The sample furnished—Mr. Routledge's pamphlet on "The Bamboo Considered as a Paper-Making Material" being printed on bamboo paper—shows it to be fully equal, indeed superior, to much of the common and cheap news paper in use. In fineness and strength it surpasses any made use of by our great dailies, and in color all but the *Herald*. It has, however, the serious fault of semi-transparency, the letterpress showing through.

As an essential point in the proposed plan of utilizing the bamboo for papermaking consists in the use of young and preferably freshly cut stems, it will be necessary to have the fiber prepared where the bamboo grows, thus adding a new industry to tropical regions.

OUR WATER SUPPLY.

In 1870 the average daily consumption of water in New York city was 85,000,000 gallons; in 1871, 87,000,000 gallons; in 1872, 90,000,000 gallons; in 1873, 100,000,000 gallons; in 1874, 102,000,000 gallons; in 1875, 107,000,000. As the Croton aqueduct is now used to nearly its full capacity, the demand for water threatens to exceed ere long the amount which the aqueduct can deliver.

About 340 square miles of territory are drained by the Croton river above the dam. On this area the rainfall is sufficient to furnish an average daily supply of 300,000,000 gallons. The actual yield of the river is very much greater, showing that many of the springs which supply its tributary streams are fed from without the Croton water shed. Croton lake, which covers some 400 acres, has a storage capacity of 500,000,000 gallons. The old reservoir in Central Park holds 150,000,000 gallons; the new reservoir, 1,000,000,000, and the distributing reservoir on Fifth avenue, about 20,000,000 gallons: making a total of about 1,670,000,000 gallons. At or near the sources of the tributaries of Croton river, in Putnam county, there are many small lakes, some of them of great depth, which have been converted into natural reservoirs by lowering their outlets. Of these, Lake Glenida covers 182 acres, and will supply 168,000,000 gallons, when drawn down 3 feet; Lake Gilead, 122 acres, drawn down 12 feet will supply 396,000,000 gallons; Lake Mahopac, 603 acres, drawn down 3 feet will supply 584,000,000 gallons; Lake Kirk, 101 acres, lowered 20 feet will supply 528,000,000 gallons; Lake Barrett, 70 acres, lowered 10 feet will supply 198,000,000 gallons; Lake China, 50 acres, lowered 10 feet will supply over 132,000,000 gallons: a total of over 2,000,000,000 gallons.

Besides these natural reservoirs, there is an artificial reservoir at Boyd's Corners having a storage capacity of 2,700,000,000 gallons, and an unfinished reservoir on the middle branch of the Croton which will have a storage capacity of 4,000,000,000 gallons. Thus the supply of storage water amounts to the enormous quantity of nearly 6,000,000,000 gallons, to be increased by the new reservoir to 10,000,000,000. In 1868 there were 9 days when the daily flow of Croton River did not furnish a full supply of water for the city; in 1869, 80 days; in 1870, 107 days; in 1871, 35 days; in 1872, 30 days; in 1873, 109 days; in 1874, 85 days; in 1875, 39 days.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE LARGEST GLASS CYLINDER IN THE WORLD.

Mr. Thomas Degnan, of the Union Glass Works in Somerville, Mass., recently made an enormous glass cylindrical shade or cover for a statue which is to be exhibited at the Centennial. The process began by inserting a long hollow iron tube into the pot of molten glass, and by careful manipulation about 75 lbs. of the latter was caused to adhere to the tube. This was then taken to a wooden mold of semi-circular form, in which it was rolled a few times by three men, and thus brought to a white heat. It was then taken to a wooden cylinder placed beneath the floor of the factory; and after it was placed therein, Mr. Degnan began the work of fashioning the cylinder to its proper proportion, which he did by blowing through the iron tube and into the body of the glass; while at the same time, two men, guided by a wave of his hand, raised and lowered the glowing cylinder gently but quickly until it came forth finished, and measured 5 feet in hight and 74 inches in circumference.

CLEANSING WATER MAINS.

It frequently happens in iron water mains that deposits of rust are formed, sufficiently thick to reduce materially the diameter of the pipe. To clean the interior, Mr. E. Dodds, an English engineer, has lately devised a pipe scraper, which operates as follows: The pipe is cut, the scraper is inserted, temporary joints are made, and the water is turned on at highest pressure, which drives the scraper on at great speed. In the first experiment, a distance of 300 yards of pipe was thoroughly cleansed in 2 minutes and 20 seconds.

CONDENSED MILK FOR CHILDREN.

Dr. Edward Smith, author of an excellent work on "Foods," thinks that condensed milk is not a suitable food as a substitute for pure milk for infants. It is more fattening but less nourishing, and greatly reduces the child's power of resisting diseases. Dr. Smith states that children brought up on impure London-fed cows' milk will resist an attack of acute disease better than children fed on condensed milk.

A NEW REFRIGERATOR CAR.

Very good success has been obtained in preserving grapes by means of a new refrigerator car which has been recently tested on the Union Pacific road. A fan blower attached to one of the axles forces air through ice, and the blast subsequently passes into the car through a perforated pipe at the bottom. After circulating among the fruit, the current returns to the blower and is again cooled. The advantage is the uniform temperature of about 40° Fah., which is maintained inside the car.

JADE.

A number of sales of Japanese and Chinese curiosities have recently taken place in this city, in which were included objects made of a material little seen in this part of the world, and about which little is here known. It is a precious stone, valuable not on account of its scarcity, because in China and Burmah large mines of it exist, but for the great difficulty encountered in cutting and carving it, necessitating an amount of patience and manual dexterity rarely found save among the inhabitants of the celestial kingdom. It is a silicate of alumina called jade, and is obtained in Tartary, various parts of China, and in the Mogoung districts of North Burmah. The true jade is hard enough to cut glass or quartz, and the most valuable pieces are of an intensely bright green hue, the ordinary material being pink and yellow. As many as 1,600 men are engaged in the jade mines of Burmah, and the substance is sometimes found in huge blocks, which three men can hardly move. The crude fragments are cut by means of thin copper disks, used in conjunction with fine silicious grit, composed of quartz and little particles resembling ruby dust. The boring of earrings and bracelets is effected by a revolving cylinder tipped at the free end with the same silicious mixture. The Chinese, with their proverbial ingenuity, make an almost perfect imitation of jade out of rice, the quality of hardness alone being absent.

AN EXPLOSIVE COPPER COMPOUND.

It has long been known that acetylen copper is a very dangerous explosive, detonating on the slightest percussion, and, worse than all, forming spontaneously on the copper pipes formerly employed to convey illuminating gas.

Recently another salt of copper has been prepared, which forms, when mixed with chlorate of potash, an explosive which may be used to fill percussion caps, torpedoes, etc. To a solution of sulphate of copper is added enough hyposulphite of soda in solution to entirely destroy the blue color. Tetrathionate of the suboxide of copper is formed, and dissolved in excess of hyposulphite of soda. To another portion of the blue vitriol solution, aqua ammonia is added until the blue precipitate, at first formed, dissolves to a dark blue solution of ammonio-oxide of copper. The two solutions are now mixed; and after long standing, a violet-colored salt crystalizes out of the beautiful blue liquor, and it is this salt which becomes explosive when mixed with chlorate of potash. The *Polytechnisches Notizblatt*, from which we obtain the above, does not state the composition of the violet salt above referred to, or the probable reason of its explosiveness, whether due to the nitrogen imparted to it by the ammonia, or to the large excess of sulphur, which latter substance, it is well known, when in a free state forms with chlorate of potash a mixture that detonates by percussion.

DEEP RED GLASS.

Pettenkofer, who analyzed the intense red glass used in antique mosaics, proposed to make it by fusing lead glass with about 9 per cent of oxide of copper and 3 per cent protosesquioxide of copper as a reducing agent. In this case, however, some of the lead is also reduced, giving a dark brown or black color to the glass, and hence Dr. Kayser employs borax as the flux. The following proportions are taken: Clean quartz sand, 60 parts; oxide of copper, 10 parts; protosesquioxide of iron, 3 parts; calcined borax, 10 parts; calcined soda, 10 parts. A high temperature should be employed during the fusing and reduction, and then it should be moderated to a dark red and kept there some time. When cold, the red glass will be covered with a thin layer of green copper glass.

ACTION OF PROTOCHLORIDE OF TIN ON CHLORATE OF POTASH.

When 2 parts by weight of stannous chloride and 1 part of potassic chlorate, both in powder, are triturated together in a porcelain mortar, the mass becomes heated in a few minutes very strongly. Beside chloric acid, large quantities of vapor of water are given off, and a yellowish white residue remains, which, when dissolved in boiling water and allowed to cool, deposits hypochlorite of potassa in splendid brilliant crystals, while the supernatant opalescent, milky mother liquor contains oxychloride of tin.

TUNGSTATE OF ZINC AS A WHITE PIGMENT.

When a solution of tungstate of soda is mixed with a solution of some zinc salt, the tungstate of zinc is precipitated as a snow-white pigment, that covers well and is recommended to artists that work in oil colors as deserving the preference over all other white pigments.

IMPROVED HAT-MAKING MACHINERY.

The manufacture of felt is a very simple process, and so ancient that it was probably in use long before textile materials prepared by the comparatively complicated processes of spinning and weaving, were invented. Tradition states that St. Clemens, the patron saint of the hatters, put wool on his sandals to protect his feet, which had become sore by long marches; and he found that, after a short time, the wool became felted together into a fabric. He commenced making cloth by a similar process, and applied the material to the manufacture of hats. But there is reason to believe that the capability, which some kinds of hair and wool possess, of being felted, was known long before St Clemens' time, as felt goods have been very long in use in China, and the ancient Greeks and Romans unquestionably wore felt hats.

If the hair or wool is capable of being felted, if it will adhere together when subjected to pressure or friction, the process is a very simple one. An examination with a microscope will at once tell if the hair is suited to the purpose: if the hair be smooth, consisting of a single cylindrical fiber, it cannot be felted at all; but the hair of beavers, rabbits, hares, and some other animals possesses, on each principal fiber, points which project obliquely, as shown in Fig. 1. When a mass of such hair is moistened and subjected to heat, pressure will cause the oblique fibers to entangle, and in a short time the hairs will be so intimately connected that a fabric equal in durability to a woven stuff will be formed.

The best hats are made of beaver hair, and hence the cheap silk imitations of the finer kinds are commonly called

Fig. 1.—HAIR OF A BEAVER, AS SEEN UNDER THE MICROSCOPE.

beavers; commoner qualities are made from the hair of otters, musk rats, and other small animals; and others, still inferior, are made from sheeps' wool, but this requires a treatment different from that for hair. Some kinds of hair, notably that of the hare, needs to be treated with a solution of the nitrate and chloride of mercury, and arsenic is applied to the skin before the hair is removed, to better adapt the hair to the felting operation. A very excellent felt for hat-making purposes is made from the fur of a large species of water rat, somewhat resembling an otter; it is a native of South America, and more than a million of the skins are annually exported from that continent for the purpose.

Originally hair was felted by being pressed together into a loosely adhering mass, and then suddenly plunged into hot water. The heat and moisture caused the hair to curl slightly, and the oblique fibers to interlock and hold the mass together in a tough fabric, which was then laid on a flat surface and repeatedly rolled with a round stick; it was then dipped again, and the rolling operation repeated. By this means a very solid sheet of felt was obtained, which, moreover, was quite plastic, and could be shapen over any smooth block, and was therefore well adapted for use in making hats. However, it was long since found that this process was tedious and expensive, and it has been abandoned in all countries where the hat manufacture is of any importance, such as the United States, England, France, and Germany. In these countries, where the trade is one of great extent and value, very expensive and elaborate machinery is employed; and the method now in use in the factories was originated by MM. Laville and Crespin, hatters of Paris, France. It consists mainly in mixing the hair in a series of large boxes communicating with each other. The hair is first conveyed on an endless belt of cloth to a cylinder, provided with fans, and rapidly revolved in the first box, in the sides of which are placed glass windows, through which the hair can be seen kept in violent commotion by the wind from the cylinder fans. The finer hairs soon adhere together, and the coarser, which are unsuited for felting, fall in a drawer in the bottom of the box, from which they are readily removed. The mass of finer hair is then placed on a felting machine, called in French *une batisseuse*. This is done by women, as shown in our Fig. 2, who spread the hair on an endless belt of linen, T, by which it is carried forward to a pair of rollers, V, which deliver the hair to a large rotary brush placed in the lower part of the case, A. The action of this brush is peculiar, and it forces the hair through the end of the case, A, in which is a long perpendicular slit, in front of which stands a cone, C, made either of sheet copper perforated with holes, or of fine wire gauze, and covered with a cloth which is kept moist. The cone is revolved by a vertical axis, and the air is exhausted from its interior, through the box-shaped base on which it stands, by an air pump. The hair ejected through the slit in case, A, is attracted to the cone by the suction; and the revolution of the cone on its axis soon causes it to be uniformly covered with a fine felted fabric. The slit can be closed with a sliding board, by manipulating which the operator is enabled to direct the stream of hair to any desired zone on the conical mold, as shown in the engraving; by this means, any part of the fabric can be made thinner or thicker than the rest. While the right hand of the operator is thus occupied, the left hand is applied to the felt to ascertain its thickness and uniformity; and when the cone is sufficiently and equally covered, the pneumatic action is stopped, and the felt is covered with a wet cloth, or, better, a tightly fitting copper cone, similar to the one within the felt. The cones and the felt are then taken away together, and plunged into a bath of hot acid, which (as before described) causes the hair to become so coherent that it may safely be lifted away from the molds. But the felt requires to be made still more dense, which is done by a mechanical process, a kind of kneading being performed upon it by wooden blocks in a machine. This not only condenses the fibers, but causes the cone to diminish in size, till it is sometimes less than one third of its original dimensions.

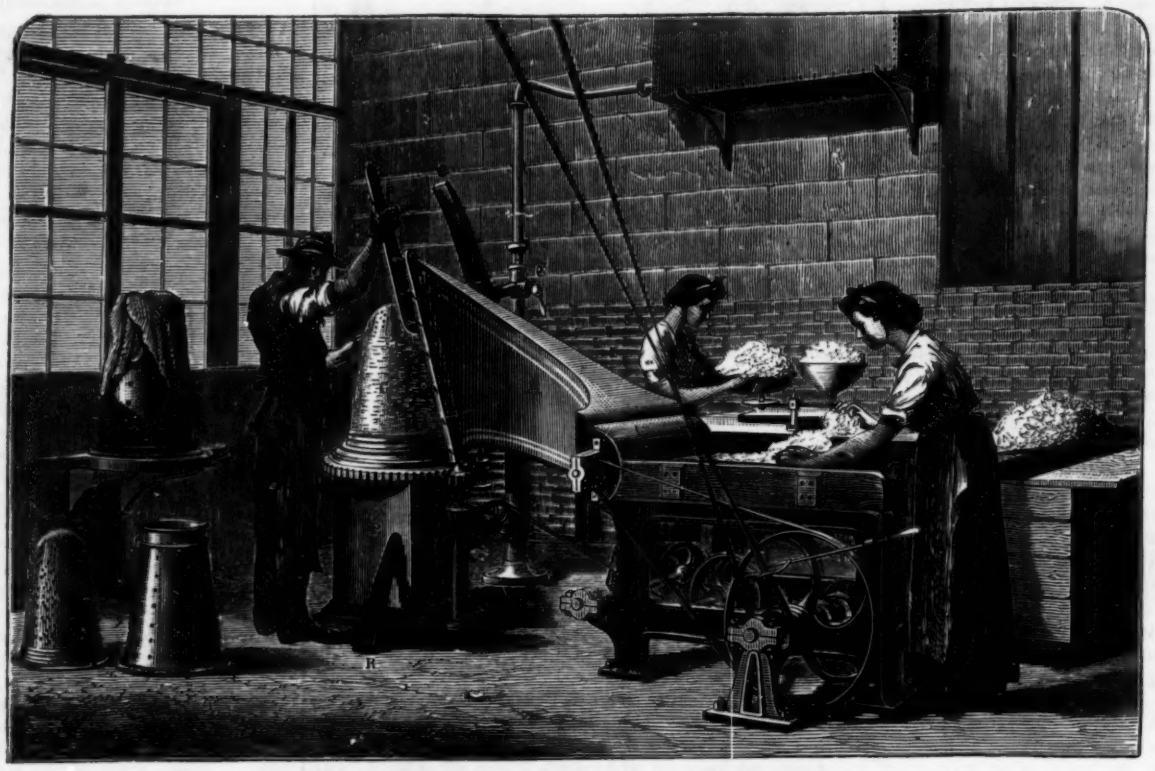


Fig. 2.—HATTER'S FELT-MAKING MACHINE.

After the hat is thus made, it needs to be shaped, dyed, and finished, the last operation consisting of polishing, ironing, and trimming. The polishing is done on a machine represented in our Fig. 3, the conical felt being drawn over a metal form and manipulated till it fits tightly. The edge or brim is then worked into shape, and trimmed to the proper dimensions; the hat is then placed on a rapidly rotating block, F, and a wire brush is pressed against it to remove superfluous hair. Pumicestone is applied to smooth the fabric, and sealskin to produce a polish. The lower side of the brim is finished by putting the hat, inverted, in a hollow form, the rim resting on a projection. The loose hair is removed by an air blast, through pipes, T, by which the hat is kept free from dust, etc., while under treatment.

Although this system, somewhat varied and improved, is in use in this country, the hat making operations have never been exhibited in any of our industrial expositions. The process was shown in Paris, in 1867, and in Vienna, in 1873, and was in each case a very interesting and attractive display, finished hats being placed before the spectators in 15 or 20 minutes after the commencement of the operation. Good practice, however, requires much more time, as the dyeing and subsequent drying are slow processes; and if the felt be hurriedly made, it will not possess much durability. If any of our hat manufacturers have sufficient enterprise to exhibit the system at the approaching Centennial Exposition, they will be likely to interest a very large proportion of the millions of visitors who are expected to throng the buildings.

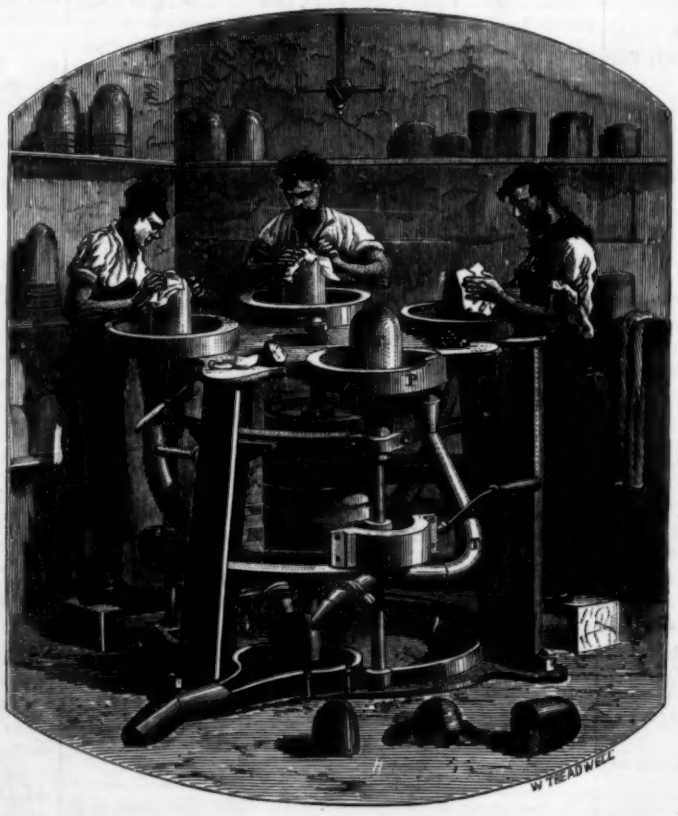


Fig. 3.—HAT MOLDING AND SHAPING MACHINERY.

A Sensible Christmas Present.

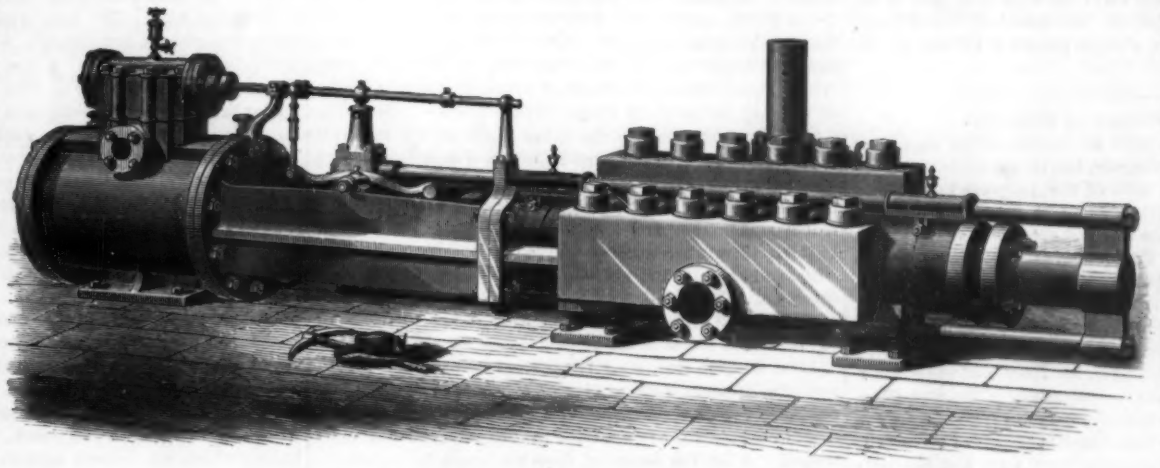
The Studebaker Brothers Manufacturing Company, of South Bend, Ind., deserve credit for a very sensible as well as generous proceeding. Just before Christmas, they printed a little circular which was distributed among the seven hundred employees of the concern, and which reads as follows. "In view of the approaching New Year and the coming Centennial Anniversary, it is our desire to present to each of you a copy of some weekly paper (such as you may select) for the year 1876 The year itself will be a memorable one, and full of incidents and interest to you all. We feel also that it will tend to encourage in many of you an increased desire for information, and will be altogether better appreciated by you than the ordinary gift of a Christmas turkey, to be eaten and forgotten." Of course the workmen took advantage of this liberal offer, and as one result a club of new subscribers appears on the rolls of the SCIENTIFIC AMERICAN.

The company suggests that we may approve this course. We do, cordially; we wish more employers would adopt the same plan. We have repeatedly advocated it, and pointed out that employers can do their workmen no better service than to render accessible to them the means of self-education and improvement. This benefits the men directly, for it gives them information both instructive and valuable, and at the same time indirectly, though none the less surely, benefits the givers themselves. Half the strikes and labor troubles between employer and employees have for their basis an ignorant unreasoning spirit existing among the latter. Open up the avenues of knowledge; put in the men's way the newspapers, whereby, under the guise of self-entertainment, they are really educating themselves; and, our word for it, there will be very much less heard of obstinate controversies and uprisings. To give a man a newspaper which keeps him posted as to the progress of his fellow beings, which tells him of new ideas and thoughts, is to lift him superior to his dull routine of every day work. By so doing, you give him something to think about, something which carries his mind far beyond the narrow horizon of his every day existence, and perhaps leads him to the development of new and useful ideas engendered in his own brain. Employers will find money thus expended well laid out; and certainly, viewed as a gift alone, none could be suggested as more appropriate than one which confers a benefit on the recipient every week in the year.

WITH four weights of respectively 1 lb., 3, 9, and 27 lbs any number of lbs. from 1 to 40 may be weighed.

THE KNOWLES HORIZONTAL MINING PUMP.

An accidental interchange of the engravings illustrating our article on the Knowles steam pump, in our issue of January 8, exhibited a cut of a different style of pump from that intended to be described, in connection with so much of the description as relates to Fig. 6. The present illustration represents the correct double acting plunger pump referred to. The absence of joints at the water end is here clearly observable. The various parts are accessible, and there is a novel arrange ment of valves, by which not only the valve, but also the valve seat, is instantly removable by simply unscrewing the cap nut. These pumps are now working on lifts equal to 1,600 feet vertical column without causing shocks or pounds of any description. Full details regarding the manufacture and trial tests of these excellent machines are given in the article above mentioned.



THE KNOWLES HORIZONTAL MINING PUMP.

STEAM HORSE FOR STREET RAILWAYS.

Mr. S. R. Mathewson, of Gilroy, Santa Clara county, Cal., has recently devised a new motor for street cars, an illustration of which is given herewith. The following description, by the inventor, will explain its operation: "The design is to make a machine resembling a horse in form, so as not to frighten the horses on the streets. To this end the form shown is chosen. The motive power is steam, generated in a tubular boiler of from four to five horse power, located inside of the horse and forward of the cab. This drives a rotary engine of my own patenting, which is geared to the driving shaft of the machine. I also propose the use of gas as fuel, so as to do away with smoke. The steam is condensed in cold water carried in a tank of sufficient capacity on top of the cab. Gas is compressed in suitable tanks to a pressure of from 80 to 100 lbs. per square inch, and is used as fuel. The boiler is so constructed as to receive a supply of hot air to feed the flame, the gases from which, after passing around the boiler, are conducted around the engine to prevent loss by condensation. The water is forced into the boiler from the condensed steam chamber. The engine is provided with a brake capable of stopping the apparatus within a space of twenty feet, while under a speed of eight miles per hour."

The inventor points out that the engineer could easily control the machine, and also collect fares and perform other duties usually done by conductors. He claims that the cost of running the apparatus will not exceed one dollar per fifteen hours, that it may be very cheaply constructed, and that its use would be productive of a very large saving to street car companies. He also states that the weight of the machine will be from 2,800 to 4,000 lbs., and that it will run at from 4 to 20 miles per hour. A cow catcher is provided, and suitable devices arranged for attaching cars.

A signal bell is fixed above the horse's head; and a lantern in front serves as a head light to give warning of its approach, when the machine is running on dark streets at night.

For further information, address the inventor as above (P. O. Box 110), or Levi Doane, Esq., San Francisco General Post Office, San Francisco, Cal.

MATHEWSON'S STEAM HORSE FOR STREET RAILWAYS.

The Type Writer.

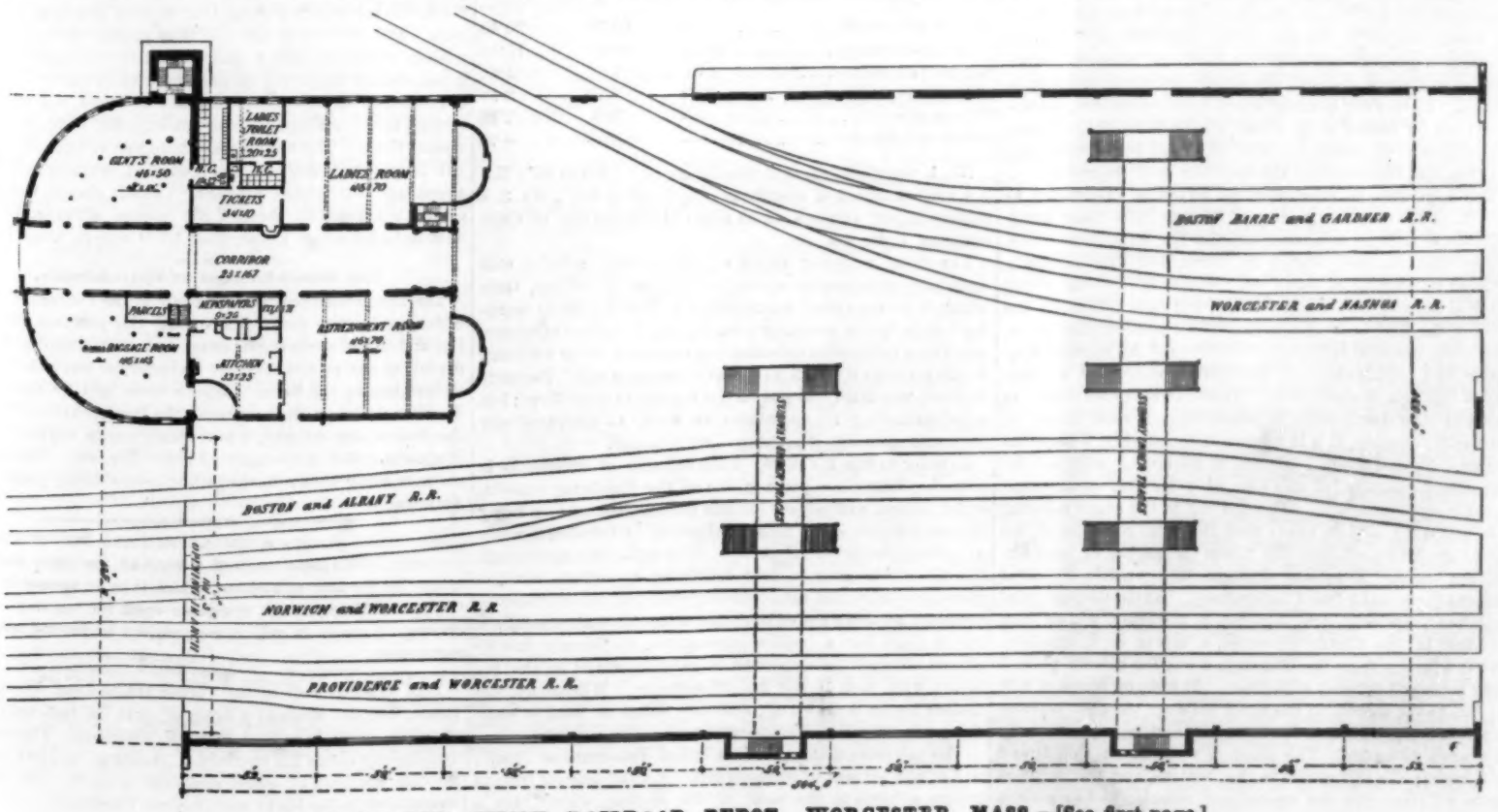
At a recent meeting of the Society of Arts, London, a machine was exhibited, intended to enable persons to write, or rather print, without using a pen. The *Journal of the Society of Arts* says:

The machine in appearance somewhat resembles an ordinary sewing machine, being mounted on a stand of the size and appearance of a sewing machine stand. In front there is a keyboard with the letters of the alphabet, numerals, etc., upon it; and on pressing one of the keys, a small lever bearing the corresponding letter is caused to strike against a ribbon saturated with a prepared ink, over which the paper is held on a roller. Each letter strikes in the same spot, but the roller with the paper moves a space forward after each letter, so that it appears on the paper in its proper place. The mechanism is very simple, the levers carrying the letters being actuated by a similar arrangement to that of a piano, and strung on a circular wire so that they all strike into the centre of the circle. By the action of a treadle, as soon as a line is finished, the roller is traversed back to its original position, and at at the same time it is revolved one tooth of a ratchet wheel, so as to bring a fresh line under the operations of the apparatus. The type is all small capitals, and the printing is perfectly regular and even. It is stated that, after a little practice, any person can work twice as fast as an ordinary writer, and that a skilled operator can gain a very much greater speed. The machine can be used for manifolding with the ordinary thin paper and carbon paper, some nineteen or twenty legible copies being obtainable. It is an American invention, and has been brought out in London by the Remington Sewing Machine Company.

[Our cotemporary is correct in stating that the improvement originated in this country It is the invention of Mr. A. E. Beach, of the SCIENTIFIC AMERICAN, patented here in 1856, in which year the American Institute awarded its gold medal for the exhibition of the instrument at the Crystal Palace, this city. The invention is rapidly coming into use in all parts of the world. The original patent has expired. The machine as now made is very effective, and fully realizes all that is said above.—ED.]

Hydrated Cellulose.

It has long been remarked that, under the influence of acids, cellulose becomes extremely friable. Paper bleached with a too large excess of chloride of lime, and linen submitted to the action of sulphurous acid, which transforms itself into sulphuric acid, may by the least pressure be reduced to powder. M. Girard, after a series of elaborate ex



PLAN OF THE UNION RAILROAD DEPOT, WORCESTER, MASS.—[See first page.]

periments, concludes that this transformation is due to the fixation of an equivalent of water by the cellulose, and he has produced the hydrate synthetically. It is a white substance, very easily pulverized. M. Girard considers that this hydration of cellulose plays an important part in the economy of nature, and that the production of rotten wood, ulmine, and ulmic acid is always preceded by that of the newly discovered hydrate.

The Manufacture of Saltpeter.

The niter beds of Chili yield an inexhaustible supply of nitrate of soda or Chili saltpeter, but this compound is, unfortunately, unsuited for most of the purposes to which its analogue and near relative, nitrate of potash or common saltpeter, is employed in the arts, and especially in the manufacture of gunpowder. The immense deposits of potash salts at Stassfurt and Kaluss furnish the means of converting the inexpensive nitrate of soda into the highly important nitrate of potash. The following description of a saltpeter manufactory at Semmering, near Vienna, as given by S. Pick, will prove interesting as an example of the contrivances usually employed and the magnitude of the operations.

1. Raw materials: Chloride of potassium from Kaluss and Stassfurt, containing not less than 80 per cent of the salt, is employed. That from Kaluss is very pure and perfectly free from magnesium salts; it is also better to work, because it is not calcined so hard, while the Stassfurt salt often comes in hard lumps which are difficult to decompose. The poorest quality of Chili saltpeter contains 93 per cent nitrate of soda; generally the guaranteed 95 per cent is all there. It is kept in a magazine lined with asphalt, the floor of which has an inclination toward one side of 1 in 100. Along this side is a gutter, likewise covered with asphalt, which leads to a vat, where the lye is collected that drains from the saltpeter, and which is more abundant in winter. The sacks, from which this salt has been poured out, still contain 2·2 to 3·3 lbs. each of salt, and are washed out in vats connected with each other like a Shanks' apparatus, four constituting a battery. As soon as the lye, which is of a dark brown color, marks 42° B., or 1·41 specific gravity, it goes into the factory.

2. The manufacture: The factory is so arranged that the liquids shall flow down automatically as much as possible; hence the reservoirs for water and lye are at the top, somewhat lower down are the dissolving vats and refining and evaporating vessels, then follow the salt filters, the crystalizing pans, and the basins for lyes, from which they are pumped into the highest reservoir again. These basins are on the ground. The room where the crystalization takes place is also covered with asphalt, so that what spatters over can easily be collected.

The decomposition of the chloride of potassium and nitrate of soda is conducted in round cast iron vessels, 8 feet 4 inches in diameter and 6 feet 8 inches deep. They are covered with strong cast iron lids made of three segments and bolted together. A man hole in the lid, which can be closed, permits of the introduction of the raw material and lyes. From another opening a tube 6½ inches in diameter carries off the vapor, and conveys it under the double bottom of the mother liquor reservoir. Through the middle of the lid passes the shaft of the stirrer, which consists of three horizontal arms. The heat is communicated by a stout coil of copper steam pipe 2½ inches diameter, making 8 windings quite near the sides and representing a heating surface of 107¼ square feet. The joints are made tight with red red lead or plates of copper, caoutchouc, paper pulp, and lead lute last but a little while. To draw off the solution with the chloride of sodium formed, there is a cock of 4 inches opening, which can be blown out by means of a small steam cock attached near the top. Beside this, there are two open 1 inch steam pipes, opening into the bottom of the kettle on opposite sides, which serve to blow out the last portions of the salt and liquor at the end of the operation; and also, if the stirrers get fast and will not move in consequence of putting in the raw material too rapidly, they help to set it in motion. In case the heating worm requires repairs, the solution can be heated with direct steam from these pipes. These dissolving vessels are also employed for evaporating the lyes, and the course of the operation is as follows:

The apparatus is filled with lye which is evaporated to 50° B. (1·53 specific gravity.) During this time much chloride of sodium separates, and the lye, as soon as it becomes concentrated, begins to foam, but this is easily avoided by putting in some oil. When the lye has about reached the required concentration, and has fallen to the level of the first or second worm, decomposition takes place. The crude material is brought to the top of the apparatus by means of a rolling chair, in iron tilting carts and emptied into it through the man hole. The Chili saltpeter is put in first and then the chloride of potassium. It must be put in gradually, because, if it is thrown in too rapidly, it stops the stirrer. From 6,600 to 7,700 lbs. of nitrate of soda and the equivalent quantity of chloride of potassium are decomposed in one operation. After putting in the crude material it is boiled for half an hour: then the total contents of the boiler are drawn off into the filters belonging to each dissolving vessel. These are wrought iron vessels, 8 feet 4 inches square and 5 feet 4 inches deep. At the deepest point each has a discharge cock 3 inches in diameter, which has, like that in the dissolving vessel, a steam cock attached. About 4 inches from the bottom is a wooden bottom pierced with holes and covered with linen. It rests on strips of iron riveted to the sides. In the space between the two bottoms is a steam pipe to warm the filter before using and to keep the wash water hot. The solution remains in this filter 2 or 3 hours; the salt settles to the bottom, and the solution flows off clear into the crystalizing vessels; it has now a density of 1·63, or 56° B., at a temperature of 203° Fah. The salt which remains in the filter, and which still contains 12 to 20 per cent nitrate of potash, is next covered with lye from the dissolving vessel, which is filled with mother liquor and heated. In a short time it is drawn off, and has a density of 48° to 50° B., and is run with the other solution directly into the crystalizing vessels. For still further washing the salt, which still contains 6 to 8 per cent of saltpeter, those lyes are used which were obtained by the previous operation of washing the salt with water. These lyes are collected in a receiver which stands at the same hight as the reservoir for mother liquor. In the reservoir is a 6 inch copper pipe which conveys exhaust steam from the engine and raises the temperature to 176° Fah., and thus produces a not inconsiderable evaporation and separation of chloride of sodium. In this reservoir are received all the lyes which are saturated with common salt, but are weak in saltpeter, and have a density of 25° to 30° B. As a rule the salt is washed twice with this, and after the second washing it has a density of 35° B., and is put with the mother liquor for evaporation.

After washing with weak lye, the salt still contains 4·5 per cent of saltpeter. This residue of saltpeter is removed by rinsing it two or three times with hot water, and the solutions thus obtained are collected in the reservoir above described. After the second of these washings, the remaining salt is heaped up to drain; the dry salt is then removed from the filter, and the remaining inconsiderable wet residue goes through again with the next batch. The salt when finished contains 0·6 to 0·9 per cent nitrate of potash, say 6·5 per cent saltpeter and 6·5 per cent water. It is stored in a magazine lined with asphalt, where a good deal of liquor runs off and is collected in a buried reservoir. On account of the large amount of nitrate of potash, it is worked over, so that a considerable part of the saltpeter which was not washed out of the salt is recovered. The author found from 7 to 13 per cent in this liquor.

The solution of saltpeter, made from chloride of potassium and Chili saltpeter, flows, through half round wrought iron gutters provided with sieves, into the crystalizing vessels. They are all provided with mechanical stirrers of two different constructions, part round and part quadrangular.

The quadrangular reservoirs, formerly used for another purpose, vary from 8 feet 4 inches to 12 feet 8 inches in width and 10 feet 8 inches to 24 feet 7 inches in length; and they are 2 feet 7 inches deep. They are provided with pendulum stirrers, making about 12 oscillations per minute. These have the advantage of requiring but very little force, but need an attendant, say one man for all the vessels, to remove the altpeter attached to the sides of the vessels. It is also unavoidable that, on the bottom, where it is impossible to remove it, a solid crust of saltpeter should form, which does not permit the mother liquor to run through.

The round crystalizing pans are of wrought iron, 13 feet 5 inches in diameter and 2 feet 10 inches deep, and the bottoms are fastened by sunken rivets. They are provided with stirrers atttached to an upright shaft.

When cold, the mother liquor is drawn off; it flows, through cast iron gutters united by flanges, into an iron reservoir placed lower down, from which it is pumped into the reservoir on the top floor for evaporation. This reservoir is not heated by the escaping steam from the dissolving vessels alone, but also by the exhaust steam of the engine after it has passed through the lye used to wash the salt. The cold mother liquor should properly have a density of only 35° B.; usually it stands at 37° to 38°, especially in summer. This is because of the chloride of magnesium in the Stassfurt chloride of potassium, which collects in the mother liquor and increases its density, and also because a small excess of Chili saltpeter is used to make the decomposition easier. One hundred volumes of mother liquor contains:

Nitrate of potash	29·40	25·5	26·40
Chloride of sodium	25·72	14·2	17·18
Sulphate of soda	1·31	1·06	1·81
Chloride of magnesium	2·10	6·20	8·19
Nitrate of soda	—	19·6	7·19
Iodide of sodium	—	—	0·76

No. 1, a mother liquor of specific gravity 1·348 at 66°; No. 2, a mother liquor of specific gravity 1·395 at 54½°; No. 3, a mother liquor through which about 11,000,000 lbs. of Chili saltpeter had gone.

The crude saltpeter which crystalizes from solution still contains a considerable amount of chloride of sodium, from which it must be freed before refining. This is done by washing it with the lye resulting from rinsing the refined saltpeter, and which is likewise collected in a reservoir. After washing, it still contains 0·8 to 2 per cent of common salt. Recently this salt was dried and put on the market as a fertilizer; but notwithstanding its usefulness as such, its comparatively high price prevents it making a rapid inroad.

In order to free it entirely from chloride of sodium, it is refined. This takes place in one of the dissolving vessels, which is used exclusively for this purpose, the solvent being the wash liquor of the refined saltpeter. A solution is made of a density of 50° or 51° B., hot. This solution runs through the filter belonging to this dissolving apparatus, remains there two hours, and runs perfectly clear into the crystallizing vessels. As these are of iron, the saltpeter that crystalizes out of them has a yellow appearance; to prevent this 3½ ounces ultramarine suspended in water is mixed in the solution with each 10,000 lbs. of saltpeter. When cold, the mother liquor is drawn off, and may either be used to wash the crude saltpeter or evaporated as occasion requires.

The saltpeter that crystalizes out of this contains from ¼ to ½ of one per cent of common salt. A small amount, in solid lumps, adheres to the teeth of the stirring wheel; this is picked out and again refined, while the rest of the saltpeter is thrown on the adjacent filters and covered with water. These filters are of wrought iron lined with thin sheet copper, 5 feet high and 8½ feet long, have perforated double bottoms covered with linen cloth, and are provided with a discharge cock. The first rinsing is made in this way: the cock is closed, and enough water run in to completely cover the saltpeter; after a few hours, the lye is run off clean, and a second washing with a little water suffices to render the saltpeter perfectly free from chlorine. The washing is stopped as soon as the wash water shows a density of 10° to 11° B. The crystalization of the refined saltpeter takes place exclusively in the round pans above described, and from 10,000 to 11,000 lbs. of saltpeter is crystalized at once.

When liquor no longer drips from the saltpeter in the filters, it is dried, and then contains from 2 to 3 per cent of water. The drying vessel is a circular pan, 8 feet 6 inches in diameter and 10 inches deep. The cast iron bottom is planed on the upper surface and cast hollow with steam channels through it for heating it. The dried material is taken out through a hole in the bottom 6 inches square, which is usually closed by a slide. In the center of the drying pan is an upright shaft, protected by a ring from contact with the saltpeter to be dried. This carries a series of knives which are pressed against the bottom by means of springs; it also has a scraper, movable vertically to push the dried saltpeter towards the discharge hole; and finally there is a conical iron roller, covered with sheet copper, in a frame that turns with the shaft. This roller is to crush the larger balls of saltpeter.

When the saltpeter is ready for drying, it is conveyed in a tilting cart to the drying pans and dumped into them, while the stirrer is set in motion, the discharge slide closed, and the scraping plate raised up. The stirring knives, by their motion, spread the saltpeter evenly over the heated bottom, and at the same time prevent its burning, while the heavy rollers crush lumps that are caked together. When the saltpeter is perfectly dry, the discharge hole is opened a little way and the saltpeter falls slowly through into a shaking sieve, through which the powder alone falls into a wooden box, whence it is transferred by a copper spiral into a wooden trough, and is then carried by an endless chain elevator to the top floor and emptied into barrels. When the drying pans are almost empty, the slide is opened all the way, and the scraping plate let down so as to sweep the remainder of the saltpeter to the opening. It is impossible to entirely prevent its burning fast and forming crusts, and hence, every 10 or 12 hours, all the burnt saltpeter must be pounded loose. It breaks off readily in large plates. This apparatus, which is also employed in Stassfurt for drying chloride of potassium, has a large capacity; the four pans will easily dry 33,000 lbs. in 24 hours.

Besides this powdered saltpeter, it is also made in sticks, but only in small quantities. Its uses are very limited; it is principally in demand by metal workers, who think its crystaline form a guarantee of its purity.

Refined Chili saltpeter is also made in large quantities and is chiefly employed for pickling meat; it is mostly in large crystals. For this purpose Chili saltpeter is dissolved in the apparatus used for refining other saltpeter, to a concentration of 44° to 45° B., then filtered and crystalized in covered vessels protected on the sides from cooling. As the Chili saltpeter is, besides, very pure, the mother liquor can frequently be used for fresh solution.—*Polytechnisches Journal.*

Recent Balloon Ascent.

MM. Albert and Gaston Tissandier made a balloon ascent from Paris lately, and after a three hours' trip alighted near Illiers, about six miles from Paris. At 800 meters above the ground they entered a solid stratum of cloud 700 meters thick, the temperature being four degrees (centigrade) below zero. At 1,500 meters altitude they passed through a succession of ice crystals, a galaxy of little hexagonal stars, which danced round the car and sparkled in the sun. These did not exist in the lower stratum of cloud, but were suspended in the atmosphere over an expanse from 150 to 200 meters thick. The temperature here was at zero, and higher still it was at six degrees, the masses of white cloud below appearing like Alpine glaciers. Cumuli clouds were perceived overhead at about 2,300 meters altitude, but the aeronauts did not go higher than 1,700 meters, about 1 mile.

The Dutch Exhibit at Philadelphia.

The Dutch Government will show at the Centennial Exhibition a collective model illustrating the progress made by Holland in hydraulic engineering, and consisting of groups of models of the principal great reclamation and other works undertaken by the State. Among them will be shown the Haarlem drainage, the new canal, the Dordrecht steel bridge, the Kuilenberg railway, a new steam pump, copper models of sluices, relief map of the Zuyder Zee, etc. The objects are now being shown to the public before being packed for America.

SOUTHERN STATES AGRICULTURAL AND INDUSTRIAL EXPOSITION.—We have received a copy of the rules and premium list for this exhibition, which is to be opened in New Orleans on February 26, to remain open for ten days. The classes of goods in which competition is invited are very numerous.

THE artesian well at the Collier White Lead Works, St. Louis, Mo., has attained a depth of over 700 feet, nearly all of which depth has been through limestone. The drift is but slightly above the encrinitial limestone, and has passed through but little of either sandstone or chert. The boring commenced in the lower Archimedean limestone.

PRACTICAL MECHANISM.

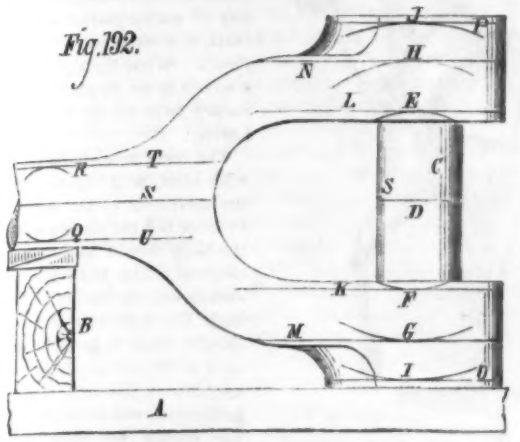
BY JOSHUA ROSE.

NUMBER XL.

LINING OUT A DOUBLE EYE.

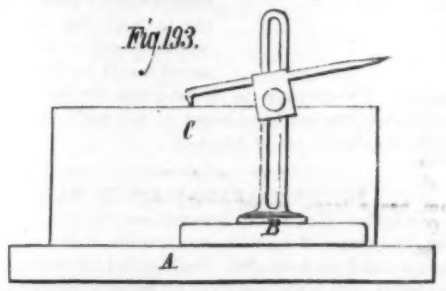
After measuring the dimensions of a double eye to ascertain if there is, upon the outline, surplus metal sufficient to permit of its clearing up all over, we apply an L square upon the outside surfaces, and a T square, with the blade between the jaws, to test if the inside and outside faces are at about a right angle to each other, or if the marking will have to be thrown to one side of the work to accommodate a want of truth in the latter. Presuming that, as is usually

Fig. 192.



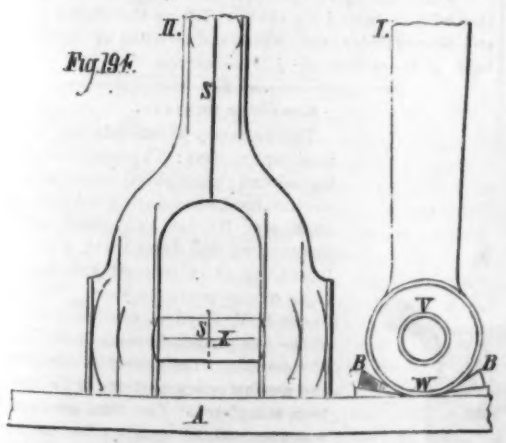
the case, the work is reasonably near to being true, we proceed as follows: Placing the double eye upon the marking-off table, as shown in Fig. 192, we block up the stem end with the pieces of wood, B, so that the horizontal faces of the work will stand about true with the surface of the table, the manner of testing the same being shown in Fig. 193, A representing the marking-off table, and B the scribing block, with the needle placed so that the point of the

Fig. 193.



bent end barely touches the surface of the work. The operation is to move the scribing block from end to end of the work and on both sides of it, packing it up until the upper surface is level, and taking care, if the work does not lie level and steady upon the table, to insert wedges in the necessary places so that the work will lie firmly and not move during the operation of marking. If there are projections upon the face of the work which rests upon the table, as is the case in our double eye, it is necessary to pass the scribing block along the under as well as the upper surface of the work; and if the two vary much, we may choose the one that is most true with the other surfaces of the work and set it true; or if, in such case, there would not be enough metal to clean up the work on both sides, we must divide the difference between the two. We then put between the jaws of the double eye, the center piece, C, and find the center of the jaws, as shown by D; then, setting a pair of compasses to half the required width between the jaws, we scribe upon both the jaws the segments of a circle, E and F, using D as a center; then opening the compasses to allow for the requisite thickness of each jaw, we mark the segments of a circle, G and H; and again setting the compasses to the requisite thickness of hub, we mark the segments of

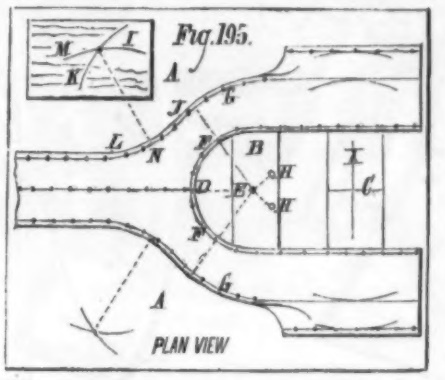
Fig. 194.



a circle, I and J. We now take a scribing block, and, setting the point just to intersect the extreme diameter in each case, we draw the lines, K and L, M and N, and O and P, thus defining the widths and thicknesses of the jaws and hubs. We then set the scriber point even with the center, D, and then draw the line, S S, which should run a long way up the stem of the double eye, because the shortness of the other lines, running parallel to it, renders it difficult to set the work true by them, and S S is made long to supply the deficiency. After setting the compasses to half the required thickness of the stem, we mark, using the line, S S, as a center, the segments of a circle, Q and R, and from them mark the lines, T and U, which define the required thickness of the stem or rod of the double eye. Our next operation will be to mark off the hole and the circle of the hub, which is done as shown in Fig. 194. Setting the eye upon the marking-off table, A, we wedge it upright, as shown in view 1, by the wedges, B; applying the blade of an L square to set the line, S S (in view 2), true by, we mark off on each side of the double eye the center of the boss or eye, and from that mark off the circles, V and W, denoting the finished sizes of the hole and the eye; then setting the scribing block needle point even with the center from which the circles, V and W, were struck, we mark on the center piece, (shown in view 2) the line, X.

We have now to complete the marking-off of the face shown in view 2, Fig. 194, which could not have been done before, because there was nothing determinate wherefrom to mark off the half circle of the outline between the jaws. Placing the double eye upon the table, as shown in Fig. 195,

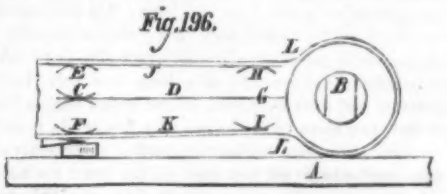
Fig. 195.



and blocking it up so that it lays level with the face of the marking-off table, and with the face that has been marked off uppermost, we insert between the jaws the center piece, B. We next mark from the center, C, the requisite distance of the crown of the curve, between the jaws, thus obtaining the center mark, D, from the center, C; and setting the compasses to half the required width between the jaws, we use D as a center, and mark upon the center piece, B, the center, E, and strike the half circle, F F, which completes the marking between the jaws. Our next procedure is to mark off the segments of circles, G, G, which are struck from the centers, H, H, respectively. Then taking the block of wood, I, which should stand at about the same hight from the marking-off table as does the body of the double eye, and setting the compasses to the required radius, we rest one point on the circle, G, at about the point, J, we strike the mark, K; then placing one leg of the compasses at about the point, L, we strike the line, M, the junction of the lines, K and M, forming the location of the center from which the segment of a circle, N, is marked. Placing the block of wood, I, on the other side of the double eye, we repeat this latter operation, and the marking on that face is complete.

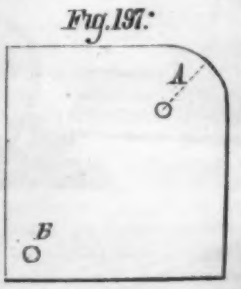
After defining the outline of our work by light center punch marks, we pass it to the machinist's hands to be turned and cut down to the lines, after which we place it upon the marking-off table in the position shown in Fig. 196, A representing the table. At each side of the double

Fig. 196.



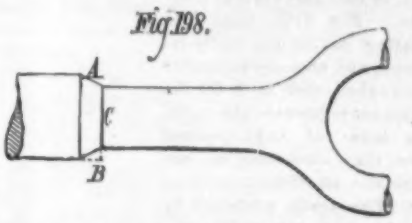
eye we place a center piece, B, and mark thereon the center of the hole with the compass callipers. We then find the center of the shank, C, and, wedging that end up with wood as shown, we set the needle of the scribing block even with the center of the hole, and so adjust the double eye with wedges that the needle point will strike the center of the hole marked on B, on each side, and also the center, C, whereupon we may mark the line, D; then setting the compasses to the requisite distance, we mark from the center, C, the segments of circles, E and F, and from the center, G, the segments of circles, H and I: and resetting the double eye so that the needle point of the scribing block will intersect the extreme outline of H and E, we draw the line, J; repeating the operation on the under side, we produce the line, K, and the operation is complete. The curves, L L, are made to a gage, such as is shown in Fig. 197; it is made of sheet iron about one sixteenth of an inch thick, the outline being carefully marked out and filed up neatly, the corner, A, being made of the necessary sweep, and the hole, B, being used to hang the gage up by. It is well to have an assortment of such gages for use in lining out, as well as for use as guides to the machinist in cutting out the curves or sweeps

Fig. 197.



When a double eye is forged separate from the rod, the intention being to weld it to its rod after the finishing is complete, which method is adopted for ease in handling the double eye, and because it can then be operated upon in a small lathe or shaping machine, the end of the cut on the stem should be beveled off, as shown at A, in Fig. 198, and

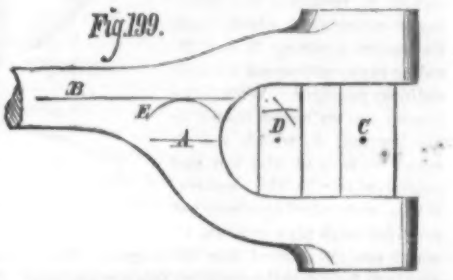
Fig. 198.



not left square, as denoted by the dotted lines at B, because, if the corner be left square, the jar of the blows given in welding the double eye to its rod would cause the metal to bend in the neck, C, and the resetting with the blacksmith's flatter would be liable to jar the eyes or jaws of the double eye out of true one with the other. Furthermore, if the body of the rod is intended to be forged down to the finished size, and either left rough or merely ground and polished by the grindstone and emery wheel, leaving the corner sharp (as shown at B) would cause the forging to leave a mark round the body of the stem, at C, giving it the appearance of being cracked.

To assist the operator in marking out, the centers from which all curves and circles on detail drawings are struck should have a small circle in red ink marked around them, and a dotted red line marked from the center to the circle or segment of circle struck from it, as shown in Fig. 195. If the double eye is, however, intended to have an offset, as shown

Fig. 199.



in Fig. 199, we draw from the centers, C and D, the line, A; and setting the compasses to the amount of the offset, we draw the segment of a circle, E, using the line, A, as a center; and from the extremity of that segment, we draw with the scribing block the line, B, which will represent the center line of the stem of the double eye, the rest of the operation being as shown in Fig. 192, and described in the accompanying explanation, from the point at which the line, S S, in that figure was drawn.

Rising in the World.

Experience continually contradicts the notion that a poor young man cannot rise. If we look over the list of rich men, we find that nearly all of them began life worth little or nothing. To any person familiar with the millionaires of the United States, a score of examples will occur. On the other hand, the sons of rich men, who began life with the capital which so many poor young men covet, frequently die beggars. It would probably not be going too far to say that a large majority of such moneyed individuals either fail outright or gradually eat up the capital with which they commenced their career.

And the reason is plain. Brought up in expensive habits, they spend entirely too much. Educated with high notions of personal importance, they will not, as they phrase it, stoop to hard work. Is it astonishing, therefore, that they are passed in the race of life by others with less capital originally, but more energy, thrift, and industry? For these virtues, after all, are worth more than money. They make money, in fact. Nay, after it is made, they enable the possessor to keep it, which most rich men pronounce to be more difficult than the making. The young man who begins life with a resolution always to lay by part of his income is sure, even without extraordinary ability, gradually to acquire a sufficiency, especially as habits of economy, which the resolution renders necessary, will make that a competence for him which would be quite insufficient for an extravagant person. It is really what we save, more than what we make, which leads us to fortune. He who enlarges his expenses as fast as his earnings increase must always be poor, no matter what his abilities. And content may be had on comparatively little. It is not in luxurious living that men find real happiness.

THE Belgian *Moniteur Industriel* says that an engineer, having a piece of very hard bronze of large diameter to turn in the lathe, could not succeed in cutting it with a tool of any kind or temper, until he kept the tools constantly moistened with petroleum, when they cut with readiness. He says, that by using a mixture of petroleum and spirits of turpentine, steel with a straw-colored temper can be worked perfectly well. The experiment certainly can be easily tried, say in turning chilled car wheels.

The Hon. George Bancroft told a reporter of the Philadelphia *Item* recently that the coming Centennial Exhibition would in every respect excel any international exhibition ever before given. He thinks it will drive away hard times and encourage immigration to an astonishing extent.

periments, concludes that this transformation is due to the fixation of an equivalent of water by the cellulose, and he has produced the hydrate synthetically. It is a white substance, very easily pulverized. M. Girard considers that this hydration of cellulose plays an important part in the economy of nature, and that the production of rotten wood, ulmine, and ulmic acid is always preceded by that of the newly discovered hydrate.

The Manufacture of Saltpeter.

The niter beds of Chili yield an inexhaustible supply of nitrate of soda or Chili saltpeter, but this compound is, unfortunately, unsuited for most of the purposes to which its analogue and near relative, nitrate of potash or common saltpeter, is employed in the arts, and especially in the manufacture of gunpowder. The immense deposits of potash salts at Stassfurt and Kaluss furnish the means of converting the inexpensive nitrate of soda into the highly important nitrate of potash. The following description of a saltpeter manufactory at Semmering, near Vienna, as given by S. Pick, will prove interesting as an example of the contrivances usually employed and the magnitude of the operations.

1. Raw materials: Chloride of potassium from Kaluss and Stassfurt, containing not less than 80 per cent of the salt, is employed. That from Kaluss is very pure and perfectly free from magnesium salts; it is also better to work, because it is not calcined so hard, while the Stassfurt salt often comes in hard lumps which are difficult to decompose. The poorest quality of Chili saltpeter contains 93 per cent nitrate of soda; generally the guaranteed 95 per cent is all there. It is kept in a magazine lined with asphalt, the floor of which has an inclination toward one side of 1 in 100. Along this side is a gutter, likewise covered with asphalt, which leads to a vat, where the lye is collected that drains from the saltpeter, and which is more abundant in winter. The sacks, from which this salt has been poured out, still contain 2·2 to 3·3 lbs. each of salt, and are washed out in vats connected with each other like a Shanks' apparatus, four constituting a battery. As soon as the lye, which is of a dark brown color, marks 42° B., or 1·41 specific gravity, it goes into the factory.

2. The manufacture: The factory is so arranged that the liquids shall flow down automatically as much as possible; hence the reservoirs for water and lye are at the top, somewhat lower down are the dissolving vats and refining and evaporating vessels, then follow the salt filters, the crystalizing pans, and the basins for lyes, from which they are pumped into the highest reservoir again. These basins are on the ground. The room where the crystalization takes place is also covered with asphalt, so that what spatters over can easily be collected.

The decomposition of the chloride of potassium and nitrate of soda is conducted in round cast iron vessels, 8 feet 4 inches in diameter and 6 feet 8 inches deep. They are covered with strong cast iron lids made of three segments and bolted together. A man hole in the lid, which can be closed, permits of the introduction of the raw material and lyes. From another opening a tube 6½ inches in diameter carries off the vapor, and conveys it under the double bottom of the mother liquor reservoir. Through the middle of the lid passes the shaft of the stirrer, which consists of three horizontal arms. The heat is communicated by a stout coil of copper steam pipe 2½ inches diameter, making 8 windings quite near the sides and representing a heating surface of 107½ square feet. The joints are made tight with red red lead or plates of copper; caoutchouc, paper pulp, and lead lute last but a little while. To draw off the solution with the chloride of sodium formed, there is a cock of 4 inches opening, which can be blown out by means of a small steam cock attached near the top. Beside this, there are two open 1 inch steam pipes, opening into the bottom of the kettle on opposite sides, which serve to blow out the last portions of the salt and liquor at the end of the operation; and also, if the stirrers get fast and will not move in consequence of putting in the raw material too rapidly, they help to set it in motion. In case the heating worm requires repairs, the solution can be heated with direct steam from these pipes. These dissolving vessels are also employed for evaporating the lyes, and the course of the operation is as follows:

The apparatus is filled with lye which is evaporated to 50° B. (1·53 specific gravity.) During this time much chloride of sodium separates, and the lye, as soon as it becomes concentrated, begins to foam, but this is easily avoided by putting in some oil. When the lye has about reached the required concentration, and has fallen to the level of the first or second worm, decomposition takes place. The crude material is brought to the top of the apparatus by means of a rolling chair, in iron tilting carts and emptied into it through the man hole. The Chili saltpeter is put in first and then the chloride of potassium. It must be put in gradually, because, if it is thrown in too rapidly, it stops the stirrer. From 6,600 to 7,700 lbs. of nitrate of soda and the equivalent quantity of chloride of potassium are decomposed in one operation. After putting in the crude material it is boiled for half an hour; then the total contents of the boiler are drawn off into the filters belonging to each dissolving vessel. These are wrought iron vessels, 8 feet 4 inches square and 5 feet 4 inches deep. At the deepest point each has a discharge cock 3 inches in diameter, which has, like that in the dissolving vessel, a steam cock attached. About 4 inches from the bottom is a wooden bottom pierced with holes and covered with linen. It rests on strips of iron riveted to the sides. In the space between the two bottoms is a steam pipe to warm the filter before using and to keep the wash water hot. The solution remains in this filter 2 or 3 hours; the salt settles to the bottom, and the solution flows off clear into the crystalizing vessels; it has now a density of 1·63, or 56° B., at a temperature of 203° Fah. The salt which remains in the filter, and which still contains 12 to 20 per cent nitrate of potash, is next covered with lye from the dissolving vessel, which is filled with mother liquor and heated. In a short time it is drawn off, and has a density of 48° to 50° B., and is run with the other solution directly into the crystalizing vessels. For still further washing the salt, which still contains 6 to 8 per cent of saltpeter, those lyes are used which were obtained by the previous operation of washing the salt with water. These lyes are collected in a receiver which stands at the same hight as the reservoir for mother liquor. In the reservoir is a 6 inch copper pipe which conveys exhaust steam from the engine and raises the temperature to 176° Fah., and thus produces a not inconsiderable evaporation and separation of chloride of sodium. In this reservoir are received all the lyes which are saturated with common salt, but are weak in saltpeter, and have a density of 25° to 30° B. As a rule the salt is washed twice with this, and after the second washing it has a density of 35° B., and is put with the mother liquor for evaporation.

After washing with weak lye, the salt still contains 4·5 per cent of saltpeter. This residue of saltpeter is removed by rinsing it two or three times with hot water, and the solutions thus obtained are collected in the reservoir above described. After the second of these washings, the remaining salt is heaped up to drain; the dry salt is then removed from the filter, and the remaining inconsiderable wet residue goes through again with the next batch. The salt when finished contains 0·6 to 0·9 per cent nitrate of potash, say 6·5 per cent saltpeter and 6·5 per cent water. It is stored in a magazine lined with asphalt, where a good deal of liquor runs off and is collected in a buried reservoir. On account of the large amount of nitrate of potash, it is worked over, so that a considerable part of the saltpeter which was not washed out of the salt is recovered. The author found from 7 to 13 per cent in this liquor.

The solution of saltpeter, made from chloride of potassium and Chili saltpeter, flows, through half round wrought iron gutters provided with sieves, into the crystalizing vessels. They are all provided with mechanical stirrers of two different constructions, part round and part quadrangular.

The quadrangular reservoirs, formerly used for another purpose, vary from 8 feet 4 inches to 12 feet 8 inches in width and 10 feet 8 inches to 24 feet 7 inches in length; and they are 2 feet 7 inches deep. They are provided with pendulum stirrers, making about 12 oscillations per minute. These have the advantage of requiring but very little force, but need an attendant, say one man for all the vessels, to remove the saltpeter attached to the sides of the vessels. It is also unavoidable that, on the bottom, where it is impossible to remove it, a solid crust of saltpeter should form, which does not permit the mother liquor to run through.

The round crystalizing pans are of wrought iron, 13 feet 5 inches in diameter and 2 feet 10 inches deep, and the bottoms are fastened by sunken rivets. They are provided with stirrers atttached to an upright shaft.

When cold, the mother liquor is drawn off; it flows, through cast iron gutters united by flanges, into an iron reservoir placed lower down, from which it is pumped into the reservoir on the top floor for evaporation. This reservoir is not heated by the escaping steam from the dissolving vessels alone, but also by the exhaust steam of the engine after it has passed through the lye used to wash the salt. The cold mother liquor should properly have a density of only 35° B.; usually it stands at 37° to 38°, especially in summer. This is because of the chloride of magnesium in the Stassfurt chloride of potassium, which collects in the mother liquor and increases its density, and also because a small excess of Chili saltpeter is used to make the decomposition easier. One hundred volumes of mother liquor contains:

Nitrate of potash	29·40	25·5	26·40
Chloride of sodium	25·72	14·2	17·18
Sulphate of soda	1·31	1 06	1·81
Chloride of magnesium	2 10	6 20	8·19
Nitrate of soda	—	19·6	7·19
Iodide of sodium	—	—	0 76

No. 1, a mother liquor of specific gravity 1·348 at 66°; No. 2, a mother liquor of specific gravity 1·395 at 54½°; No. 3, a mother liquor through which about 11,000,000 lbs. of Chili saltpeter had gone.

The crude saltpeter which crystalizes from solution still contains a considerable amount of chloride of sodium, from which it must be freed before refining. This is done by washing it with the lye resulting from rinsing the refined saltpeter, and which is likewise collected in a reservoir. After washing, it still contains 0·8 to 2 per cent of common salt. Recently this salt was dried and put on the market as a fertilizer; but notwithstanding its usefulness as such, its comparatively high price prevents it making a rapid inroad.

In order to free it entirely from chloride of sodium, it is refined. This takes place in one of the dissolving vessels, which is used exclusively for this purpose, the solvent being the wash liquor of the refined saltpeter. A solution is made of a density of 50° or 51° B., hot. This solution runs through the filter belonging to this dissolving apparatus, remains there two hours, and runs perfectly clear into the crystalizing vessels. As these are of iron, the saltpeter that crystalizes out of them has a yellow appearance; to prevent this 3½ ounces ultramarine suspended in water is mixed in the solution with each 10,000 lbs. of saltpeter. When cold, the mother liquor is drawn off, and may either be used to wash the crude saltpeter or evaporated as occasion requires.

The saltpeter that crystalizes out of this contains from ¼ to ½ of one per cent of common salt. A small amount, in solid lumps, adheres to the teeth of the stirring wheel; this is picked out and again refined, while the rest of the saltpeter is thrown on the adjacent filters and covered with water. These filters are of wrought iron lined with thin sheet copper, 5 feet high and 8½ feet long, have perforated double bottoms covered with linen cloth, and are provided with a discharge cock. The first rinsing is made in this way: the cock is closed, and enough water run in to completely cover the saltpeter; after a few hours, the lye is run off clean, and a second washing with a little water suffices to render the saltpeter perfectly free from chlorine. The washing is stopped as soon as the wash water shows a density of 10° to 11° B. The crystalization of the refined saltpeter takes place exclusively in the round pans above described, and from 10,000 to 11,000 lbs. of saltpeter is crystalized at once.

When liquor no longer drips from the saltpeter in the filters, it is dried, and then contains from 2 to 3 per cent of water. The drying vessel is a circular pan, 8 feet 6 inches in diameter and 10 inches deep. The cast iron bottom is planed on the upper surface and cast hollow with steam channels through it for heating it. The dried material is taken out through a hole in the bottom 6 inches square, which is usually closed by a slide. In the center of the drying pan is an upright shaft, protected by a ring from contact with the saltpeter to be dried. This carries a series of knives which are pressed against the bottom by means of springs; it also has a scraper, movable vertically to push the dried saltpeter towards the discharge hole; and finally there is a conical iron roller, covered with sheet copper, in a frame that turns with the shaft. This roller is to crush the larger balls of saltpeter.

When the saltpeter is ready for drying, it is conveyed in a tilting cart to the drying pans and dumped into them, while the stirrer is set in motion, the discharge slide closed, and the scraping plate raised up. The stirring knives, by their motion, spread the saltpeter evenly over the heated bottom, and at the same time prevent its burning, while the heavy rollers crush lumps that are caked together. When the saltpeter is perfectly dry, the discharge hole is opened a little way and the saltpeter falls slowly through into a shaking sieve, through which the powder alone falls into a wooden box, whence it is transferred by a copper spiral into a wooden trough, and is then carried by an endless chain elevator to the top floor and emptied into barrels. When the drying pans are almost empty, the slide is opened all the way, and the scraping plate let down so as to sweep the remainder of the saltpeter to the opening. It is impossible to entirely prevent its burning fast and forming crusts, and hence, every 10 or 12 hours, all the burnt saltpeter must be pounded loose. It breaks off readily in large plates. This apparatus, which is also employed in Stassfurt for drying chloride of potassium, has a large capacity; the four pans will easily dry 33,000 lbs. in 24 hours.

Besides this powdered saltpeter, it is also made in sticks, but only in small quantities. Its uses are very limited; it is principally in demand by metal workers, who think its crystaline form a guarantee of its purity.

Refined Chili saltpeter is also made in large quantities and is chiefly employed for pickling meat; it is mostly in large crystals. For this purpose Chili saltpeter is dissolved in the apparatus used for refining other saltpeter, to a concentration of 44° to 45° B., then filtered and crystalized in covered vessels protected on the sides from cooling. As the Chili saltpeter is, besides, very pure, the mother liquor can frequently be used for fresh solution.—*Polytechnisches Journal.*

Recent Balloon Ascent.

MM. Albert and Gaston Tissandier made a balloon ascent from Paris lately, and after a three hours' trip alighted near Illiers, about six miles from Paris. At 800 meters above the ground they entered a solid stratum of cloud 700 meters thick, the temperature being four degrees (centigrade) below zero. At 1,500 meters altitude they passed through a succession of ice crystals, a galaxy of little hexagonal stars, which danced round the car and sparkled in the sun. These did not exist in the lower stratum of cloud, but were suspended in the atmosphere over an expanse from 150 to 200 meters thick. The temperature here was at zero, and higher still it was at six degrees, the masses of white cloud below appearing like Alpine glaciers. Cumuli clouds were perceived overhead at about 2,300 meters altitude, but the aeronauts did not go higher than 1,700 meters, about 1 mile.

The Dutch Exhibit at Philadelphia.

The Dutch Government will show at the Centennial Exhibition a collective model illustrating the progress made by Holland in hydraulic engineering, and consisting of groups of models of the principal great reclamation and other works undertaken by the State. Among them will be shown the Haarlem drainage, the new canal, the Dordrecht steel bridge, the Kuilenberg railway, a new steam pump, copper models of sluices, relief map of the Zuyder Zee, etc. The objects are now being shown to the public before being packed for America.

SOUTHERN STATES AGRICULTURAL AND INDUSTRIAL EXPOSITION.—We have received a copy of the rules and premium list for this exhibition, which is to be opened in New Orleans on February 26, to remain open for ten days. The classes of goods in which competition is invited are very numerous.

THE artesian well at the Collier White Lead Works, St. Louis, Mo, has attained a depth of over 700 feet, nearly all of which depth has been through limestone. The drift is but slightly above the encrinitial limestone, and has passed through but little of either sandstone or chert. The boring commenced in the lower Archimedean limestone.

PRACTICAL MECHANISM.

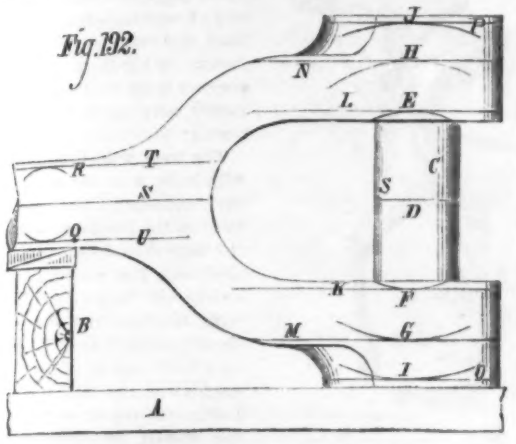
BY JOSHUA ROSE.

NUMBER XL.

LINING OUT A DOUBLE EYE.

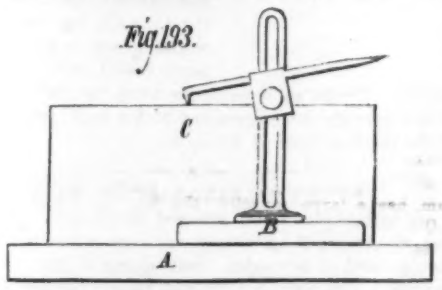
After measuring the dimensions of a double eye to ascertain if there is, upon the outline, surplus metal sufficient to permit of its clearing up all over, we apply an L square upon the outside surfaces, and a T square, with the blade between the jaws, to test if the inside and outside faces are at about a right angle to each other, or if the marking will have to be thrown to one side of the work to accommodate a want of truth in the latter. Presuming that, as is usually

Fig. 192.



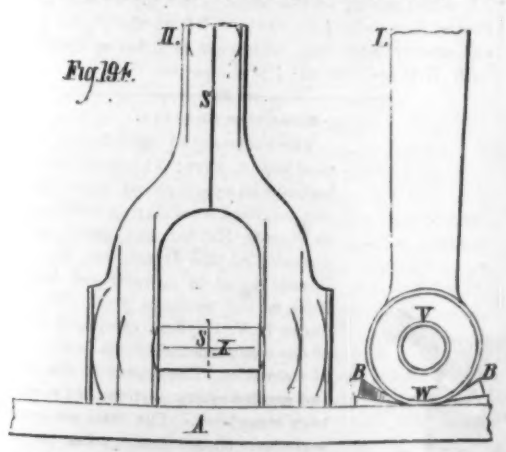
the case, the work is reasonably near to being true, we proceed as follows: Placing the double eye upon the marking-off table, as shown in Fig. 192, we block up the stem end with the pieces of wood, B, so that the horizontal faces of the work will stand about true with the surface of the table, the manner of testing the same being shown in Fig. 193, A representing the marking-off table, and B the scribing block, with the needle placed so that the point of the

Fig. 193.



bent end barely touches the surface of the work. The operation is to move the scribing block from end to end of the work and on both sides of it, packing it up until the upper surface is level, and taking care, if the work does not lie level and steady upon the table, to insert wedges in the necessary places so that the work will lie firmly and not move during the operation of marking. If there are projections upon the face of the work which rests upon the table, as is the case in our double eye, it is necessary to pass the scribing block along the under as well as the upper surface of the work; and if the two vary much, we may choose the one that is most true with the other surfaces of the work and set it true; or if, in such case, there would not be enough metal to clean up the work on both sides, we must divide the difference between the two. We then put between the jaws of the double eye, the center piece, C, and find the center of the jaws, as shown by D; then, setting a pair of compasses to half the required width between the jaws, we scribe upon both the jaws the segments of a circle, E and F, using D as a center; then opening the compasses to allow for the requisite thickness of each jaw, we mark the segments of a circle, G and H; and again setting the compasses to the requisite thickness of hub, we mark the segments of

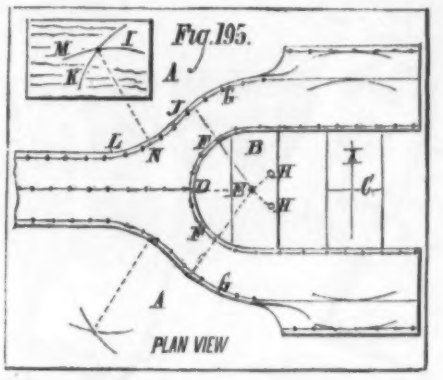
Fig. 194.



a circle, I and J. We now take a scribing block, and, setting the point just to intersect the extreme diameter in each case, we draw the lines, K and L, M and N, and O and P, thus defining the widths and thicknesses of the jaws and hubs. We then set the scriber point even with the center, D, and then draw the line, S S, which should run a long way up the stem of the double eye, because the shortness of the other lines, running parallel to it, renders it difficult to set the work true by them, and S S is made long to supply the deficiency. After setting the compasses to half the required thickness of the stem, we mark, using the line, S S, as a center, the segments of a circle, Q and R, and from them mark the lines, T and U, which define the required thickness of the stem or rod of the double eye. Our next operation will be to mark off the hole and the circle of the hub, which is done as shown in Fig. 194. Setting the eye upon the marking-off table, A, we wedge it upright, as shown in view 1, by the wedges, B; applying the blade of an L square to set the line, S S (in view 2), true by, we mark off on each side of the double eye the center of the boss or eye, and from that mark off the circles, V and W, denoting the finished sizes of the hole and the eye; then setting the scribing block needle point even with the center from which the circles, V and W, were struck, we mark on the center piece, (shown in view 2) the line, X.

We have now to complete the marking-off of the face shown in view 2, Fig. 194, which could not have been done before, because there was nothing determinate wherefrom to mark off the half circle of the outline between the jaws. Placing the double eye upon the table, as shown in Fig. 195,

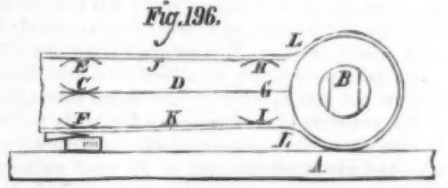
Fig. 195.



and blocking it up so that it lays level with the face of the marking-off table, and with the face that has been marked off uppermost, we insert between the jaws the center piece, B. We next mark from the center, C, the requisite distance of the crown of the curve, between the jaws, thus obtaining the center mark, D, from the center, C; and setting the compasses to half the required width between the jaws, we use D as a center, and mark upon the center piece, B, the center, E, and strike the half circle, F F, which completes the marking between the jaws. Our next procedure is to mark off the segments of circles, G, G, which are struck from the centers, H, H, respectively. Then taking the block of wood, I, which should stand at about the same hight from the marking-off table as does the body of the double eye, and setting the compasses to the required radius, we rest one point on the circle, G, at about the point, J, we strike the mark, K; then placing one leg of the compasses at about the point, L, we strike the line, M, the junction of the lines, K and M, forming the location of the center from which the segment of a circle, N, is marked. Placing the block of wood, I, on the other side of the double eye, we repeat this latter operation, and the marking on that face is complete.

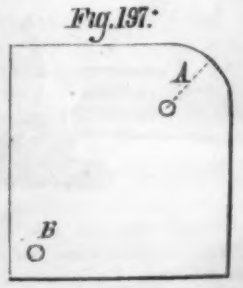
After defining the outline of our work by light center punch marks, we pass it to the machinist's hands to be turned and cut down to the lines, after which we place it upon the marking-off table in the position shown in Fig. 196, A representing the table. At each side of the double

Fig. 196.



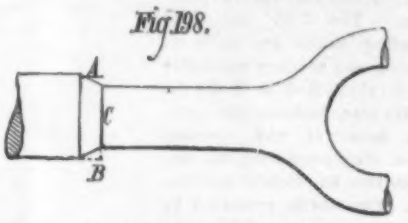
eye we place a center piece, B, and mark thereon the center of the hole with the compass callipers. We then find the center of the shank, C, and, wedging that end up with wood as shown, we set the needle of the scribing block even with the center of the hole, and so adjust the double eye with wedges that the needle point will strike the center of the hole marked on B, on each side, and also the center, C, whereupon we may mark the line, D; then setting the compasses to the requisite distance, we mark from the center, C, the segments of circles, E and F, and from the center, G, the segments of circles, H and I: and resetting the double eye so that the needle point of the scribing block will intersect the extreme outline of H and E, we draw the line, J; repeating the operation on the under side, we produce the line, K, and the operation is complete. The curves, L L, are made to a gage, such as is shown in Fig. 197; it is made of sheet iron about one sixteenth of an inch thick, the outline being carefully marked out and filed up neatly, the corner, A, being made of the necessary sweep, and the hole, B, being used to hang the gage up by. It is well to have an assortment of such gages for use in lining out, as well as for use as guides to the machinist in cutting out the curves or sweeps

Fig. 197.



When a double eye is forged separate from the rod, the intention being to weld it to its rod after the finishing is complete, which method is adopted for ease in handling the double eye, and because it can then be operated upon in a small lathe or shaping machine, the end of the cut on the stem should be beveled off, as shown at A, in Fig. 198, and

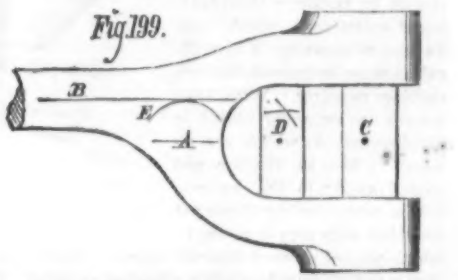
Fig. 198.



not left square, as denoted by the dotted lines at B, because, if the corner be left square, the jar of the blows given in welding the double eye to its rod would cause the metal to bend in the neck, C, and the resetting with the blacksmith's flatter would be liable to jar the eyes or jaws of the double eye out of true one with the other. Furthermore, if the body of the rod is intended to be forged down to the finished size, and either left rough or merely ground and polished by the grindstone and emery wheel, leaving the corner sharp (as shown at B) would cause the forging to leave a mark round the body of the stem, at C, giving it the appearance of being cracked.

To assist the operator in marking out, the centers from which all curves and circles on detail drawings are struck should have a small circle in red ink marked around them, and a dotted red line marked from the center to the circle or segment of circle struck from it, as shown in Fig. 195. If the double eye is, however, intended to have an offset, as shown

Fig. 199.



in Fig. 199, we draw from the centers, C and D, the line, A; and setting the compasses to the amount of the offset, we draw the segment of a circle, E, using the line, A, as a center; and from the extremity of that segment, we draw with the scribing block the line, B, which will represent the center line of the stem of the double eye, the rest of the operation being as shown in Fig. 192, and described in the accompanying explanation, from the point at which the line, S S, in that figure was drawn.

Rising in the World.

Experience continually contradicts the notion that a poor young man cannot rise. If we look over the list of rich men, we find that nearly all of them began life worth little or nothing. To any person familiar with the millionaires of the United States, a score of examples will occur. On the other hand, the sons of rich men, who began life with the capital which so many poor young men covet, frequently die beggars. It would probably not be going too far to say that a large majority of such moneyed individuals either fail outright or gradually eat up the capital with which they commenced their career.

And the reason is plain. Brought up in expensive habits, they spend entirely too much. Educated with high notions of personal importance, they will not, as they phrase it, stoop to hard work. Is it astonishing, therefore, that they are passed in the race of life by others with less capital originally, but more energy, thrift, and industry? For these virtues, after all, are worth more than money. They make money, in fact. Nay, after it is made, they enable the possessor to keep it, which most rich men pronounce to be more difficult than the making. The young man who begins life with a resolution always to lay by part of his income is sure, even without extraordinary ability, gradually to acquire a sufficiency, especially as habits of economy, which the resolution renders necessary, will make that a competence for him which would be quite insufficient for an extravagant person. It is really what we save, more than what we make, which leads us to fortune. He who enlarges his expenses as fast as his earnings increase must always be poor, no matter what his abilities. And content may be had on comparatively little. It is not in luxurious living that men find real happiness.

THE Belgian *Moniteur Industriel* says that an engineer, having a piece of very hard bronze of large diameter to turn in the lathe, could not succeed in cutting it with a tool of any kind or temper, until he kept the tools constantly moistened with petroleum, when they cut with readiness. He says, that by using a mixture of petroleum and spirits of turpentine, steel with a straw-colored temper can be worked perfectly well. The experiment certainly can be easily tried, say in turning chilled car wheels.

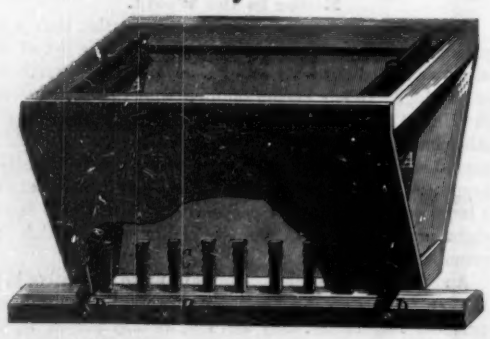
The Hon. George Bancroft told a reporter of the Philadelphia *Item* recently that the coming Centennial Exhibition would in every respect excel any international exhibition ever before given. He thinks it will drive away hard times and encourage immigration to an astonishing extent.

IMPROVED COTTON PLANTER.

In the annexed engraving is represented an improved cotton planter, which plants two rows at a time in drills, distributing the seed in the same manner as a grain drill distributes grain. The rows may be made three, three and a half, or four feet apart at pleasure. The drill teeth for planting cotton are easily removed, and as many cultivator teeth substituted as to fill the entire space between the teeth, the latter of any required form, thus converting the machine into an efficient cultivator. The teeth preferred by the inventor are of his own construction, and can be set either to run shallow and just shave the top of the ground or to penetrate to a depth of six or eight inches. Ordinarily one horse is able to draw the machine. When deep cultivating is to be done, a pole may be used so that two horses may be attached. By leaving out one or two of the middle teeth, two horses may be used in cultivating young cotton or corn, by straddling the row.

A general view of the implement in use is given in Fig. 1. Fig. 2 represents the improvement in the hopper, designed to facilitate the planting of cotton seed, which, from its fibrous covering, it is difficult to cause to descend through ordinary passages. Within the hopper are swinging plates or diaphragms, A, which are pivoted to bars at the top and extend nearly to the bottom. B is a reciprocating stirrer rod provided with pins or teeth, C, which project upward into the hopper. The object of these pins is to facilitate the working down of the seed. The stirrer rod is hung in stirrups in the lower ends of pendent bars, D. By means of the cam arrangement, E, on the wheels, Fig. 1, the stirrer rod, B, is vibrated, and also the diaphragms, A. The seed in the hopper is, by the latter, given an alternate vibrating action from end to end of the receptacle, this movement increasing in intensity toward the bottom, at which point the ends of the plates have the greatest

Fig. 2



swinging motion. The seed is thus freely delivered; and when mixed with fertilizers, its distribution is in no wise hindered.

Patented October 28, 1873 For further particulars, relative to rights to manufacture, etc., address the inventor, Mr. Pierpont Seymour, East Bloomfield, Ontario county, N. Y.

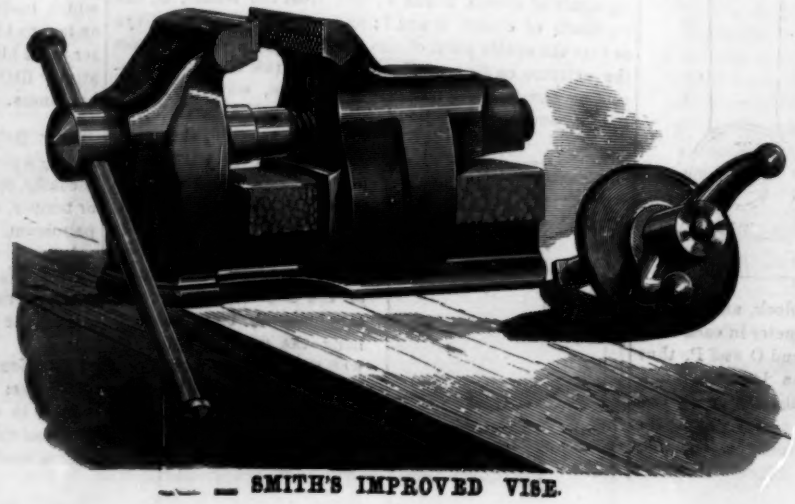
Fig. 1.

SEYMOUR'S COTTON PLANTER.

IMPROVED VISE.

The vise is one of the oldest and most familiar tools extant, and has been the subject of great numbers of patents The following is a description of one of the best improvements on this indispensable appliance. A vise, to attain and retain a position as a standard with mechanics, must supply the following qualifications: Strength to allow of chipping or filing the work without a possibility of the vise breaking; the inertia of the anvil should be sufficient to absorb the effect of blows; the jaws should move parallel and freely, and should be arranged in such a manner as to get the whole power of the screw; all parts should be durable; and lastly, the tool should be furnished cheaply.

The accompanying engraving represents an excellent form of vise devised by Mr. H. B. Smith, one of the earliest and most successful patentees of woodworking machinery. An inspection of the engraving will show how the foregoing requirements are supplied. The jaws are steel-faced by welding, and massive strength and inertia are secured by a proper and plentiful use of metal. The motion is direct, and all the vises to be quickly and economically made. The manufacturer can be addressed at Smithville, Burlington county, N. J.



SMITH'S IMPROVED VISE.

Whale Artillery.

On a small island opposite to the town of Wadso, in the extreme north of Norway, there exists an establishment the like of which is probably not to be met with in any part of the world Its most appropriate designation would be, perhaps, a slaughter yard for whales; and Mr. Foyn, its proprietor, conducts the business of capturing and cutting up the monsters in a manner peculiarly his own. Instead of fitting out the usual sized vessels, intended to make long voyages and bring home only the most useful parts of the animal, Mr. Foyn employs small—one hundred and fifty to one hundred and eighty tons—screw steamers, shoots his fish with a cannon, and has them towed back, one by one, as they are captured, to the shambles at Wadso. As the fishing grounds are within easy reach of the latter, the steamers, as a rule, secure and return with a prize within twelve hours' time. With respect to the cannon employed, it is a gun having a chamber about four feet long; this is mounted on the forecastle of the vessel, and, being very accurately balanced, can be easily moved to allow an exact aim to be taken. The projectile in use consists of a long iron bolt, having at its extreme end four harpoons, bound round with a line so as to be flat, and close to the harpoons a five or six pounder shell. As soon as the steamer has approached sufficiently near to the fish—and whales off that part of the coast are not over shy, allowing a vessel to come within shot—the bolt is fired off, and, if well directed, penetrates deeply into the flesh and blubber of the animal. The whale then naturally rushes off at a furious pace, thinking thus to elude his pursuers. Unfortunately for him, however, no step could be more suicidal, for the effect of his rapid movement is to make the bolt slip back a little, thus setting free the four harpoons from the lines, and, by means of a mechanical arrangement, causing a shell to explode. This generally proves the *coup de grace*, killing the fish outright; but occasionally the animal is not sufficiently hard hit, and its capture is not so easily effected, as it dashes away at a tremendous speed, dragging the steamer after it.

Pedestrian Training.

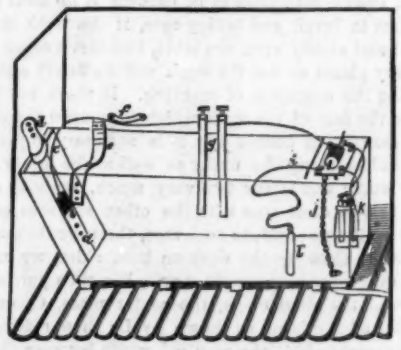
Pedestrianism, as an athletic exercise, has become deservedly popular. There is no course of gymnastics so well calculated to develope a large number of muscles, or to produce so beneficial an effect upon the system. There is a right way and a wrong way of walking—the one beneficial, the other negative in its result. What the right way is, a writer in an English contemporary tells us in the following:

The body must be held erect, with head well thrown back; the movement of the legs must be from the hip downward, and the body should be carried motionless. The arms should be swung well forward in harmony with the legs, and the elbow should, when in front, be nearly on a level and at almost right angles with the chin, the hands being open and extended. The leg should be brought well round from the hip, and the heel deposited on the ground in line with the rear foot, so as to leave your footmarks pretty nearly in a line. But above all things hold your head up and the body erect.

Stitches and other kindred annoyances are common in learning to walk, but the beginner would do well to walk it off, and never ease if he is seized with distress. To do so is to throw away the pace he has acquired from the commencement of his walk, and to knock all the regularity out of his stride.

POTIN'S GALVANO-ELECTRIC BATH.

The bath is blue slate, grooved and bedded in with red lead, and cramped up with iron cramps or nuts and bolts; it should stand on a wooden cradle either of elm or oak, and be protected by matchboarding all round; the floor should be tiled if on the basement, and covered with zinc if above. *a* is a board with holes to raise or lower the zinc plate; it is



grooved at the sides, and enters into the slate at the bottom of the bath by two iron pegs. *b* is a zinc plate; *c* a copper wire; *d* a flannel cushion for the head; *e* is a three inch webbing to support the head or nape of the neck; *f* is a handle, *g* hot and cold water taps with gutta percha tubing attached; *h* is a coil resting on the board; *i* is a copper wire in connection with carbon; *j* is a chain to lift up the plug; *k* is an acid and zinc cylinder, etc., which can be fitted up outside of the bath if there is room; *l* is the carbon.

Scientific Surveys.

The Secretary of the Interior, in his annual report, says: The results of the geological and geographical survey of the Territories, conducted during the past session by Messrs. Hayden and Powell, under the direction of this department, will, it is believed, equal in interest and importance those of any previous year. The survey, under F. V. Hayden, continued its labors of the two preceding years in the Territory of Colorado. The survey of the southern and southwestern portions of Colorado has been completed. The total area surveyed was about 30,000 square miles, portions of which were rugged. The exploration of the remarkable pre-historic ruins of Southern Colorado, glimpses of which were obtained the preceding season, was continued with great success. The survey under J. W. Powell continued the labors of the preceding year in the Territory of Utah. Nearly 10,000 square miles of country were surveyed during the season just closed.

THE GARDENS AT SCHONBRUNN.

The gardens at Schönbrunn, the Emperor of Austria's palace, situated about 1¼ miles from Vienna, are renowned for their extent and beauty, and also for their completeness, the botanical collection being one of the finest in the world. They also contain a large and important menagerie, and a system of waterworks and fountains. We give herewith a view of gardens, selected from the English *Garden*; and a correspondent accompanies it with the following remarks:

"The creation of ornamental gardens in all parts of Europe, and, in fact, throughout the world, is becoming a matter of common occurrence. Not only are private gardens, of great importance in an artistic point of view, being formed, but also public parks and gardens of great extent; and this is calling into requisition the highest talent at command in that department of horticultural art. In the gardens of the Château of Schönbrunn, cropped masses of trees serve as grand walls of verdure, in which niches are cut for statuary; and one of these artificial avenues, that represented in the illustration, leads to the beautiful spring *Schöne Brunnen*, from which the name of the original castle was derived. The spring is now enclosed in an elaborately wrought marble framework, and the center of the basin is decorated with statuary, after the manner employed at Versailles. The gloriette, a temple displaying a colonnade, is seen in the distance, rising above several lofty walls of foliage, in front of each of which are shrubs of lower stature, which are left to assume their natural growth; and the contrast between the trimmed and the untrimmed forms is far from displeasing. The magnificent gardens attached to the Château Schönbrunn, from the great hight of the vast walls of verdure above alluded to, the profusion of statuary, and other decorative objects, so placed as to produce the best possible effect, form grand models of the formal style of treatment, and are well worthy of the careful study and earnest attention of every practitioner of the art of decorative gardening on a large scale."

Electric Pile in Sesquioxide of Iron.

This apparatus is contained in a square glass jar. The pile is composed of a prism of charcoal which contains sesquioxideof iron in its pores, and a small rod of amalgamated zinc Th e latter passes through the stopper, to the under surface of which is fixed the charcoal. A solution of ammonium chlo ride is used as the exciting fluid. The reactions are the same as in Léclanché's couple, in which oxide of manganese is used. When the circuit is closed, the chloride of ammonium attacks the zinc, forming a double chloride of zinc and ammonium. The latter, on being set at liberty, decomposes the sesquioxide of iron, carrying off a part of its oxygen and forming free ammonia, which disappears by evaporation. This pile ceases to act so long as the circuit remains open. Its durability and force are large. Its electromotive power is as 12 to 10 of the sulphate of copper battery, and it is thus well adapted for industrial purposes. The inventors are MM. Clamond and Gaiffé, and it is manufactured by the latter gentleman.

The Chilian Exhibition.

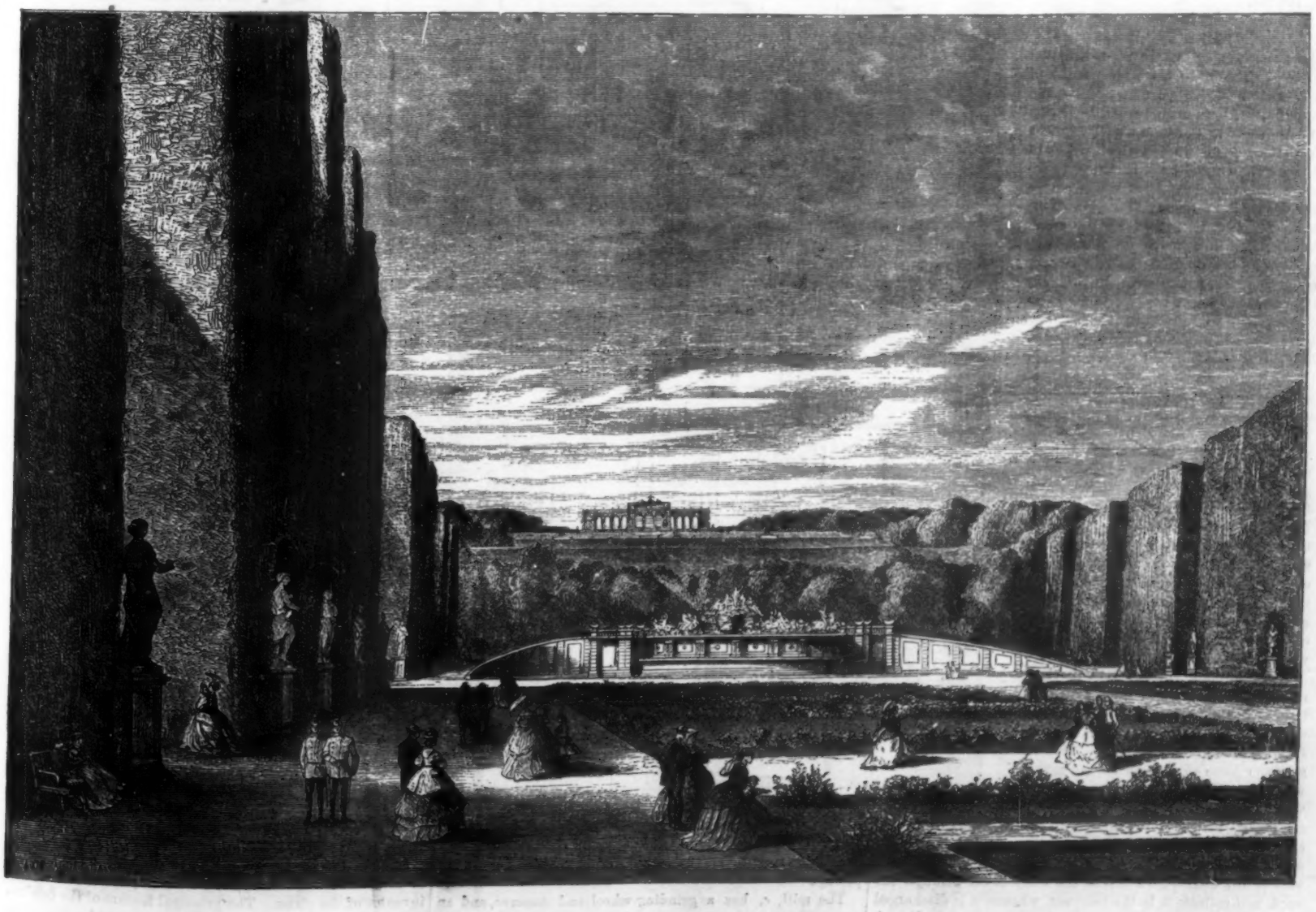
The annual festivities in commemoration of the National Independence of Chili have this year commenced with the formal opening of the International Exhibition at Santiago The ceremony of inauguration was held in the beautiful park in front of the main building, the guests assembling in a spacious and ornamental pavilion erected for the occasion. Passing through the vestibule, the first impression on entering the central hall is a little disappointing. The interior is spacious, but rather cold in its decoration. It is 150 feet in length, about 60 feet broad, and 50 feet in hight; it is well lighted, and, had it been filled with more artistic manufactures, would have formed the center of attraction. The space, however, is devoted exclusively to German goods, and the show is decidedly poor and wanting in effect. A trophy of leather in an oak case breaks the vista down the centre; on either side are pianos and some organs, and further on are glass cases containing toys, and ornamented above by bird cages. There is hardly time to examine the objects exhibited in the remoter parts of the hall, but a glance towards the sides shows that, beyond the toys and other bazaar-like articles, are displays of goods from German manufacturers which will compete with Sheffield, Birmingham, and other industries. In the south gallery are displays of needlework and embroidery by the pupils of various charitable institutions. And beyond there is a splendid collection of Chilian mineralogy, prepared by Señor Domeyko, who has been indefatigable in his efforts. The excellence of the classification and display causes the visitor to be immediately impressed with the variety and richness of the mineral products distributed throughout the republic. In the same gallery is exhibited a collection of all the native woods, with a description of their properties and uses. In the quadrangle, under an iron roof, the educational apparatus is displayed, which includes the exhibition of the College of Agriculture, and the space is filled with working models of farming machinery, skeletons and diagrams of animals, and cognate aids to instruction. In the quadrangle on the corresponding side are objects from San Salvador and Brazil. The machinery annexe is of corrugated iron with the sides open, in length 500 feet, and about 60 feet across. A central platform over the revolving shafting passes from one end of the building to the other, and enables visitors to inspect the machinery working below. The machines exhibited are multifarious; the sawing mills of the Canadian Watercourse Company attract a good deal of attention. Mining, hauling, pumping, pressing, and farming machinery occupies the whole of the space. At the end of this building is an annexe belonging to Messrs. Robey & Co., where they exhibit agricultural machinery, and further to the west is the machinery of Ransome, Sims, & Co. Crossing over the grounds to the eastern side, we come upon the annexe of Messrs. Rose-Innes & Co., similar to the building on the west, but closed at the sides. This is the only part of the exhibition which is absolutely completed. On entering we come into a large room ornamented with trophies of steel tools and manufactured articles. A fine stand of plated goods of James Dixon & Sons, of Sheffield, is prominent; beyond, a stand of Rodgers' cutlery, crucibles of the Plumbago Crucible Company, and articles of dozens of other well known English makers attract the attention. Side by side with the English tools of Firth and others are those of the Douglas Axe Company and other American makers. Two small doors lead into the machinery department, and here again the display is representative from the number of English manufactures brought together. Here are the ponderous thrashing machines of Clayton, Shuttleworth & Co., and near stands a Pitt's thrasher, less substantial, but much more easily moved. Besides the agricultural machinery, there are mining pumps, sawing machinery, and presses, all in full work; four or five small steam engines are under steam, besides the one driving the central shafting. Emerging at the further end, we come upon a small model of a mineral line, with a tiny train making the ascent of a very steep incline, carrying with it the operator in the car. The line has a center cogged rail, and the locomotive an extra cog wheel to supplement the ordinary driving wheels when a severe gradient has to be passed. The model is exhibited by Clark & Co., the *concessionnaires* of the Transandine Railway, which is to connect Valparaiso with Buenos Ayres; and the last annexe is occupied by English and American machinery imported by that firm.

German Exhibition in 1878.

An exhibition of somewhat unusual character will be opened in Berlin in 1878, the plans for it being already under discussion by an executive committee. Its object being to show Germans what Germans can do, and therefore in what points head can be made against foreign competition, the whole arrangements will be strictly national. The exhibition will be classified in twenty-one groups, and prizes will be awarded in medals distinguished as for production, manufacture, commerce, art, science and education. Workmen's models will also be issued.

Exhaustion of the Soil by Apple Trees.

The author calculates that, in a life of sixty years, an apple tree removes from the soil 60 lbs. of nitrogen, equal to 11,500 lbs. of farmyard dung. To maintain the soil in condition, therefore, about 175 lbs. of dung ought to be annually given per tree during the fifty years that it is in bearing.—*M. I. Pierre.*



THE IMPERIAL GARDENS AT SCHONBRUNN. AUSTRIA

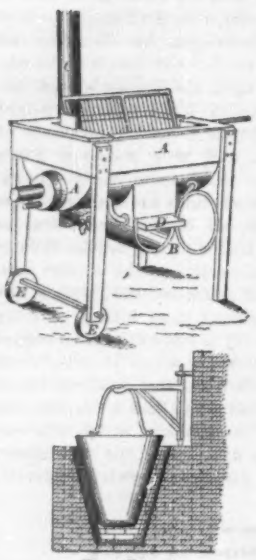
CHEESE AND CIDER MAKING AND LARD RENDERING.

Continuing our series of abstracts from Knight's "New Mechanical Dictionary,"* we give herewith illustrated descriptions of various apparatus used in the operations named in the above heading. The necessity for preserving a certain temperature in

CHEESE VATS

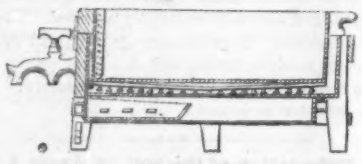
has given rise to numerous devices, among which may be cited that illustrated at A, in Fig. 1. The vat is here semi-cylindrical and double walled, water being contained between the shells. Under the vat is a furnace, B, for heating the water, the smoke escaping by chimney, C. D is a damper for regulating the heat applied to the water, and said heat is equalized by a coil of circulating pipes connecting the water space at the center and ends of the vat. To aid in drawing off the water and whey, and discharging the curd, the machine is set on eccentrics at E. The wire frame shown cuts the curd into small blocks and sweeps it from the inner surface of the receptacle. The vat used in making Parmesan cheese in Italy is also represented in Fig. 1. It is a copper caldron slung from a crane over a conical fire place. In this the milk is heated and coagulated, and, without removing, is broken by a stick having cross wires. The curd is then again heated, taken out,

Fig. 1.



Cheese-Vats.

Fig 2.



Cheese-Vat.

drained, salted, pressed, and in forty days is moved to the cheese loft.

In Fig. 2 the pan is hinged to the vat and rests upon pins within it. The contents are warmed by a furnace beneath, and the whey is draw off by a strainer. Adjustable legs permit the inclination of the vat.

Fig. 3 represents two

CHEESE PRESSES,

the upper one of which is constructed of iron. The hoop containing the curd is placed in the bottom plate, A, and the upper plate, B, is made to descend upon it. On the axis, C, of the wheel, D, there is a pinion of eight teeth which works in a rack, R. On the axis, E, there is another pinion of eight teeth which acts in the wheel, D, of twenty-four teeth. This axis, E, may be turned by the crank handle, H, three turns of which will make the rack descend through a space equal to eight of its teeth. In this way the plate, B, may be lowered to touch the cheese, and to commence the pressure; but when the latter becomes considerable, the second method of acting upon the rack is resorted to. On the axis, E, besides the pinion before mentioned, there is a fixed ratchet wheel, F; the lever, I, which embraces F, is also placed on this axis, but turns freely round it. A pawl, turning on the pin, may be made to engage in the notches of the ratchet wheel, F. By means of this arrangement, when I is raised up and the pawl engaged in F, the axis and its pinion will be turned round with great power on depressing the end, I, of the lever; and by alternately raising and depressing I, any degree of pressure required may be given to the cheese, and continued by the suspended weight, W.

The pneumatic cheese press, B, shown in the lower part of the same figure, consists of a stand about three feet high, on the top of which is a metallic vessel, *a*, forming a hoop for the curd. This vessel has a loose corrugated bottom covered with wire cloth. The bottom of the vessel communicates by a pipe, *c*, with a receiver, *d*, which is exhausted of air by means of an air air pump, *b*, and pipe, *e*. The curd being salted and placed in a cloth in the vessel, *a*, the pump is worked, and the pressure of the atmosphere drives the whey down through the curd, and collects it in the receiver, whence it is discharged by the faucet, *f*. Another form of press, shown in Fig. 4, involves the use of the toggle, as the leverage increases as the platen descends. The weight is suspended by a chain which runs over the pulley on the end of the long arm of the toggle. A hand lever operates the screw for quick movements. A variety of

CIDER MILLS

is given in Fig. 5. The common cider mill, *a*, used in the

Fig. 3.

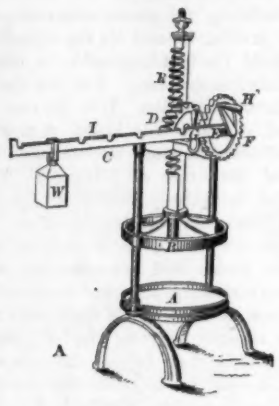
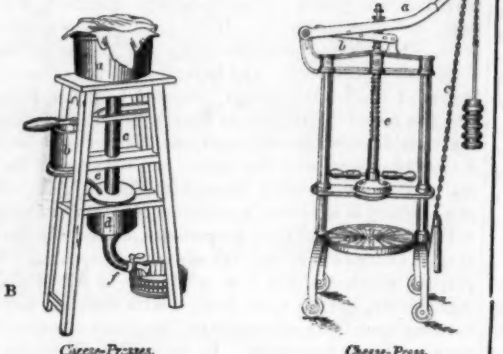


Fig. 4.

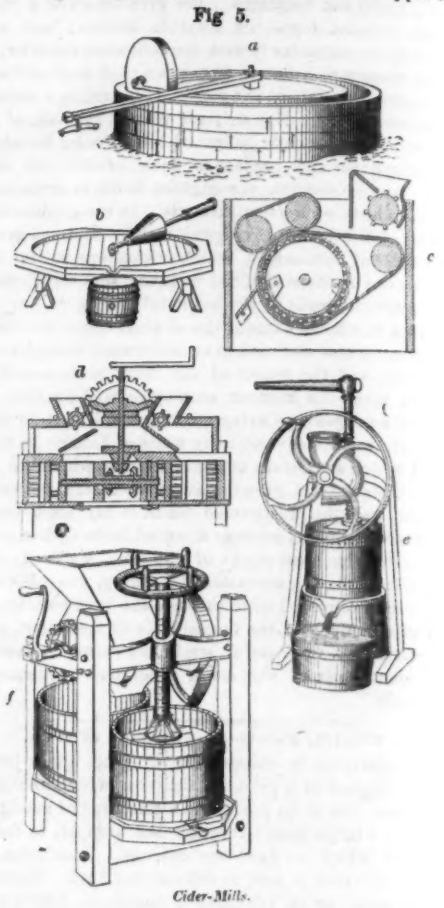


Cheese-Presses. *Cheese-Press.*

southwest of England, has a cylindrical stone, weighing one or two tuns, and rotating in an annular trough of masonry. The axis of the stone is connected by arms to a sweep, which is pivoted on a central post, and revolved by a horse. In some cases the central space forms compartments for holding apples. The cider mill, *b*, used in the south of France, has a platform of boards framed together, and is traversed by a conical frustum of cast iron. The axis of the latter is hooked to a rotating eye in the center of the platform, and is swept around by manual power, crushing the fruit in its passage

The mill, *c*, has a grinding wheel and concave, and an apron which carries the pomace between two pressing rollers, and a wire screen through which the juice runs. *d* has alternate grinding portions, and a double-headed piston which presses the pomace against the ends of the box alternately, one end of the box is filling while the other is pressing. *e* has a metallic grinder and a hoop with a screw. *f* has a grinder and presser which may act simultaneously. A hoop filled with grindings is pushed from below the hopper to be-

Fig 5.



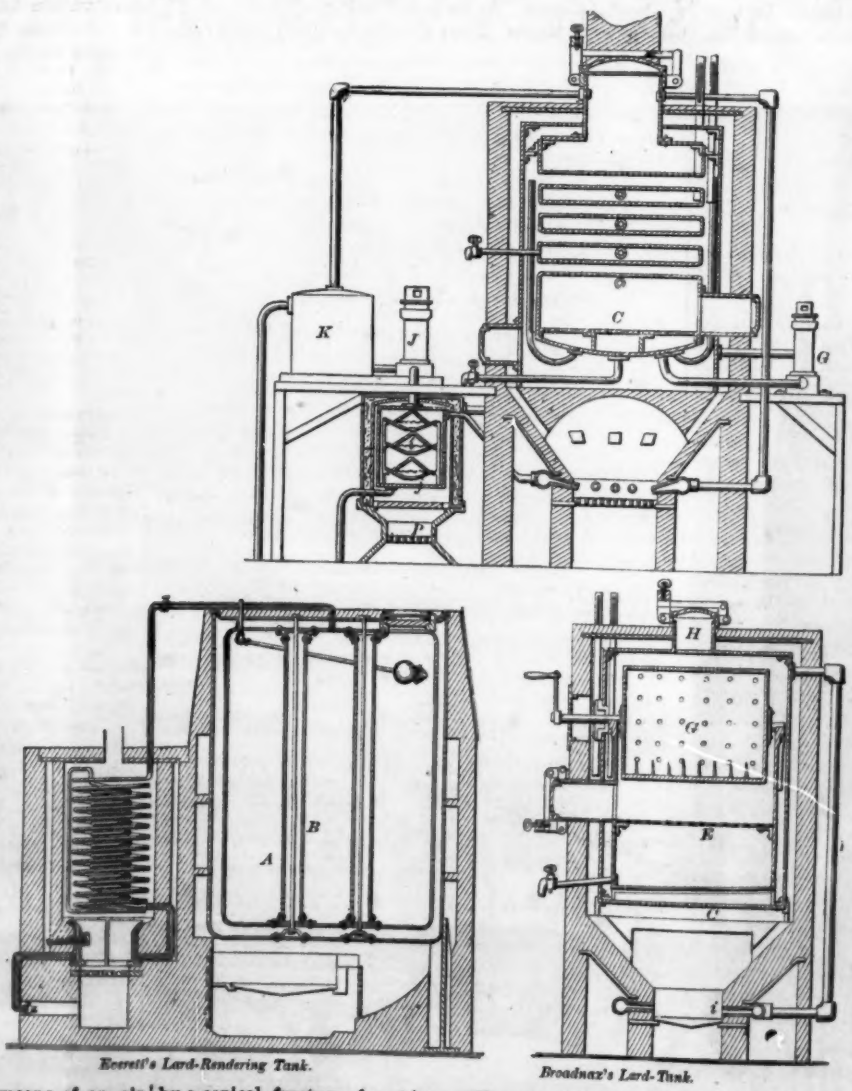
Cider-Mills.

neath the screw, and an empty hoop substituted beneath the former.

LARD TANKS

are vats in which fats are cooked to obtain them free from watery matters and membrane. We give three forms of the apparatus in Fig. 6. Everett's tank (left lower part of figure) has a digester containing the fat, which is surrounded by an outer shell constituting a hot water and steam space, to which it is connected by stay rods, which unite the water space at bottom with the steam space at top, and pass through the vertical flues, A B. The vapors from the digester, charged with odors and organic matter, pass through a pipe at the top of the apparatus into a superheating coil over the furnace, into which they are finally discharged to be consumed. A spiral flue surrounds the outer case of the boiler.

Fig. 6



Everett's Lard-Rendering Tank. *Broadnax's Lard-Tank.*

Broadnax's apparatus consists of an exterior casing, in which the digester (which may be of the form shown either in the upper or lower part of the figure) is placed. In the first it is stationary, and consists of an inner and outer shell, between which and through the flues in the inner one, A A, the heat circulates. The rendered fat in a fluid condition descends from shelf to shelf, and is strained through the perforated bottom, C, whence it is drawn off. The furnace has an inclined flue at each side, through which the products of combustion pass to and around the digester. Gases from the latter are delivered into the furnace. This may be effected as shown in the upper figure by an air pump, J, and condenser, K, by which the gases are forced through a cylinder, heated by grate, P. In the cylinder the watery particles are condensed by a series of plates, *i j*, and drawn off by a pipe. The dry vapor ascends through another pipe, to assist in heating the furnace. In the lower figure the perforated digester, G, is mounted on trunnions and rotated by a crank. The oil exuding is strained through the diaphragm, E, and the gases pass through the pipe, *i*, to the furnace. H is the charging manhole, situated on the top of the apparatus.

Inventor of the Piano.

A committee has been formed at Florence for the purpose of celebrating, next May, the centenary of Cristofori, the inventor of the piano. The principal feature of the celebration will be international concerts on a grand scale. The Abbé Liszt has promised to play.

*Published in numbers by Messrs. Hurd & Houghton, New York city.

[For the Scientific American.]

THE NATURE OF THE NEWLY DISCOVERED FORCE.

BY GEORGE M. BEARD, M. D.

In my letters to the *Tribune* and in my lecture before the Polytechnic Club, I advanced a theory of the force recently discovered by Mr. Edison, that might perhaps ally it to electricity, though not to any known form, and account for its non-polarity and other phenomena exhibited by it. This theory I suggested and used merely as a temporary working hypothesis. At the present time, the weight of evidence in my mind is in favor of the theory that this is a radiant force, somewhere between light and heat on the one hand and magnetism and electricity on the other, with some of the features of all these forces. Experiments of the following kind are of themselves powerful arguments in favor of this theory:

When the wire conducting the force from the battery to the dark box is divided in the air, and the ends are separated even a sixteenth of an inch, no spark appears in the dark box. Lay these ends of the wire on a semi-conductor, as wood, and the force will pass when they are separated a moderate distance. Place small pieces of tinfoil about these ends as they are suspended in the air, and the force now passes one inch or perhaps several inches through the air. Place pieces of tinfoil of larger surface about these ends, and separate them a wider distance, and the force will yet pass. Make the surfaces of tinfoil larger still, until they are a foot square or more, and the force will travel several feet through the air. Prepare three large pieces of tinfoil, place one piece on each end of the divided wire suspended as before, and the other piece about equidistant between them; and still the spark may be seen (though faintly and irregularly) in the dark box. The force must jump from the piece of tinfoil at one end of the wire to the middle piece, which acts as a kind of resting place, and thence to the piece at the other end of the wire. The spark has been obtained (though with difficulty, and only after very nice adjustment of the pencil points in the dark box) after having passed through four pieces of tinfoil, the distance from the first piece to the last being eight feet. The highest tension statical electricity, as generated by Holtz' machine, could not do this; and electricity prefers to pass by points. Through experiments of this kind we have learnt one important law of this force, namely, that it prefers to pass through surfaces; and the larger the surface, the better it passes through any bad conductor, at least within certain limits.

Phenomena of the kind here described suggest magnetism more than induction or dynamical electricity: but this force does not respond to the test of magnetism, the power to attract iron; and moreover it exhibits phenomena that do not belong to magnetism. It is attracted by iron and other metals, as conductors, but it does not itself attract iron.

The points which favor the radiant theory of this force may be thus recapitulated:

1. It does not respond to any of the physical tests of electricity, except the spark.

2. It produces no perceptible or demonstrable physiological effects, like electricity.

3. It is not resisted by non-conductors as air, water, glass, rubber, and paraffin, to the same degree as electricity.

4. It gives no evidence, in any of its phenomena, of polarity.

5. It passes through non-conductors, as air, rubber, glass, etc, most readily by large surfaces at the terminals, while electricity prefers to pass by points.

6. It diminishes in strength with the distance from the battery, possibly in some definite ratio, although that is not yet demonstrated.

Any form of electricity giving a spark like the spark of this force would respond to some of the physical tests of electricity, would produce readily perceptible physiological effects, would be powerfully resisted by the air, and would in all its phenomena suggest polarity, even if rapidly reversed.

Again, the four facts regarded by me as favoring the theory that this force is allied to electricity, are, when severely analyzed, not so convincing as they might at first appear. The spark of this force resembles the spark of dynamical electricity; but so also does the spark produced by combustion. The velocity of this force is great, but so also is that of light. This force is best conducted by metals; but so also is heat. This force is resisted somewhat by non-conductors, but so also is heat, and both to a less degree than electricity.

If it be, as I have suggested, a kind of electricity which, after the manner of the shuttle, returns to its source by rapid forward and backward movements, it would yet be electricity under very different conditions from those under which we are wont to consider it, and would be practically a new force. The more I experiment in this department, and the more closely I reflect on the results of experiments, the farther I seem to be driven from the electrical toward the radiant theory of this force; and there would appear to be no ready escape from the conclusion that we have here something radically different from what has before been observed by Science. The relation of this force to the other forces may be thus represented:

Light, Heat . . . New Force . . . . . Magnetism, Electricity.

The above would represent Mr. Edison's theory of a radiant force, nearer to light and heat than to magnetism or electricity.

The theory I have suggested would bring the force nearer to magnetism and electricity than to light or heat, as follows:

Light, Heat . . . . . New Force . . . Magnetism, Electricity.

The discovery that broad surfaces at the terminals are necessary to conduct this force through non-conducting solid bodies, as glass, rubber, paraffin, etc, was made but a few nights ago. That the force passed through air when large surfaces were at the terminals had been proved previously by Mr. Edison's experiments and by my own. A large surface of tinfoil (6x6 or 12x12 inches) was connected with one end of the divided wire, and laid on a table. Over this were placed broad pieces of hard rubber, glass, or paraffin, and on the top of these was placed a similar piece of tinfoil connected with the other end of the divided wire, through which the force was to be conducted to the dark box. In this way, it was proved that the force could pass through 2¼ inches of dry wood, 2 plates of glass, each ¼ of an inch in thickness, ¼ of an inch of hard rubber, ¼ of an inch of solid paraffin, and 5 layers of paraffin paper. When the surfaces at the ends of the wire were reduced in size, or when the tinfoil at one end was removed, the force passed less easily. When the tinfoil at both ends was removed, and only a few inches of fine wire constituted the surface, the force passed, but through thinner resistance. When only the terminals of the wires were applied to the resisting body, the force would not pass at all, or but a very short distance. The force passed through 8 inches of water, and was apparently but little diminished even when the surface at the terminals was but an inch of fine wire.

Useful Recipes for the Shop, the Household, and the Farm.

A new compound for polishing and cleaning metals is composed of 1 oz. carbonate of ammonia dissolved in 4 ozs. water; with this is mixed 16 ozs. Paris white. A moistened sponge is dipped in the powder, and rubbed lightly over the surface of the metal, after which the powder is dusted off, leaving a fine brilliant luster.

A new alloy for bell metal is proposed, which does not tarnish, is less liable to crack, gives a better sound, and is much lighter in weight than the alloy usually employed for the purpose. It is prepared as follows: Nickel 1 lb. and copper 6 lbs. are melted and cooled. Add zinc 2 lbs., aluminum ¼ oz. Melt and cool. Melt again, and finally add ¼ oz. quicksilver and 6 lbs. melted copper.

A very beautiful application of electro-metallurgy is to apply a coat of silver by electro deposition on natural leaves and flowers. By this means very delicate ornaments are produced, since the precise form and texture of the natural leaf are produced under the thin silver film.

Lemons can be preserved by varnishing them with a solution of shellac in alcohol. The skin of shellac formed is easily removed by rubbing the fruit in the hands.

J. Q. R. B. says; Varnish made with alcohol will get dull and spongy by the evaporation of the alcohol, which leaves water in the varnish, as all commercial alcohol contains water. Take thin sheet gelatin, cut it in strips, and put it in the varnish; it will absorb most of the water, and the varnish can be used clear and bright till the last drop. The gelatin will get quite soft; it can then be taken and dried, and used again. "I have used this plan for the last two years in photographic varnish, and have never had to throw away one drop."

There is no simpler remedy for preventing cider growing sour than mustard seed. After the cider has fermented and reached the desired palatable condition, put 1 pint mustard seed to a barrel of cider, and bung tight.

DECISIONS OF THE COURTS.

United States Circuit Court—District of New Jersey.

PATENT SKATES.—GEORGE B. TURRELL *vs.* EDWARD SPAETH AND CHARLES QUELICHER.

[In equity—Before Nixon, J.]

NIXON, J.:

This suit is for the infringement of reissued letters patent, dated April 6, 1875, for "improvement in Skates," of which the complainant became the owner by assignment on the 18th of April, 1875. The bill was filed July 6, 1875, charging the defendants with infringement, and praying for an injunction, and for an account of the gains and profits made by the defendants, and of all the damages sustained by the complainant from the said infringement.

The complainant is taking testimony to prove his *prima facie* case, and has issued a subpœna *duces tecum* to one of the defendants, Edward Spaeth, requiring him to produce before the Examiner all "books, papers, and documents whatsoever, that will show the number of skates made or delivered by the defendants, or their employees, since the 6th day of April, 1875."

The defendants complain that this is not an honest inquiry into their acts to sustain the charge of infringement, but an attempt, by an abuse of the process of the court, to ascertain the nature, extent, and direction of their business affairs. While they express themselves willing to make a full exhibit of all their manufacture and sale of skates from the date of the last reissue of the patent to the commencement of this suit, they protest that the complainant is not entitled at this stage of the proceedings, and before a decree against them for infringement, to compel an exposure of their business matters since the last-named date. They have accordingly applied for, and obtained, a rule upon the complainant to show cause before the court (1) "why the subpœna *duces tecum* should not be modified by inserting the clause 'and until the commencement of this suit' after the words and figures '6th day of April, 1875,'" and (2) "why the defendants should not be excused from disclosing to the complainant, in the complainant's *prima facie* case, what defendants have or have not done since the commencement of this action."

The counsel for the complainant justifies the questions propounded, and the call for the books, exhibiting the amount and character of the business of the defendants since the filing of the bill, on the ground that the complainant's patent is for a combination; that it already appears in evidence that the defendants have a contract to manufacture the skates, which are sworn to be an infringement of the complainant's patent, and to deliver them to persons who are not licensees of the patentee; that a number of such skates are yet to be made and delivered under said contract; that it further appears that the defendants are accustomed to make large quantities of the parts of skates interchangeable, and to put them together afterward; that it is admitted in their testimony that some of these parts were manufactured before the commencement of the suit; and the object of the present inquiry is to ascertain whether the other parts of the skates have not been manufactured since, and whether the parts made before filing the bill have not since been united to form skates, so that what was done after the reissue and before the suit has been contradictory to the infringement.

The reissued patent owned by the complainant, and for the infringement of which the suit is brought, is undoubtedly for a combination in the specifications. The inventor states that the nature of his invention consists in the combination, with a skate and the lateral-acting clamps, of mechanism that operates to move the clamps toward each other with sufficient force to cause them to grasp the sole, and hold the skate to the boot or shoe.

The first claim of the reissue is for—

The combination, in a skate, of clamps for grasping the sole, a plate or rest for the foot, and mechanism for moving and holding the clamps.

The second is for—

The clamps for grasping the heel and the clamps for grasping the sole, combined with mechanism operating and holding both sets of clamps, substantially as specified.

And the law is well settled that such a patent is not infringed by the use of some of the parts which make up the combination, the other parts being omitted, unless the place of the discarded constituents is supplied by something substantially equivalent.

As was remarked by Mr. Justice Nelson in delivering the opinion of the Supreme Court in Vance *vs.* Campbell (1 Black, 439):

Unless the combination is maintained, the whole of the invention fails. The combination is an entirety; if one of the elements is given up, the thing claimed disappears.

Hence, also, it was held in Gould *vs.* Rees (15 Wall, 194), that "where the defendant, in constructing a machine, omits entirely one of the ingredients of the plaintiff's combination, without substituting any other, he does not infringe; and if he substitutes another in the place of the one omitted, which is new or which performs a substantially different function, or if it is old, but was not known at the date of the plaintiff's invention as a proper substitute for the omitted ingredient, then he does not infringe."

The complainant seeks to establish his *prima facie* case of infringement by putting one of the defendants on the stand as a witness, and proving by him what the defendants have done. He calls his attention to Exhibit No. 1, and asks whether he has made skates substantially like that. The witness admits that he has, and that the defendants have a contract to furnish such skates to the firm of Peck & Snyder. He is then requested to produce the contract, which he properly declines to do, alleging as a reason that he does not wish to disclose to rivals the price which they were to receive, nor the number to be manufactured; but he again admits that it was a contract to deliver skates very nearly like Exhibit No. 1 of complainant. The sole pertinent inquiry now is the fact of the infringement, and that fact will not be made any more evident by producing the contract than it has been by the admissions of the defendants. The extent of the infringement is a different question, and will only arise, if at all, upon a reference for an account after a decree for the complainant.

He then continues the defendants' examination as follows:

Q. 25. Do you keep books of account which show how many skates like Exhibit 1 you make, the deliveries of such skates, and the dates of such delivery?

A. Yes.

Q. 34. Will you produce those books of account at the next adjournment?

(Objected to, because complainant has no right to compel the witness to produce his books at this stage of the suit, and because he has not served any subpœna *duces tecum* upon him, and he has no right to such subpœna.

A. I decline throwing our books open to the complainant.

Q. 25. In manufacturing skates under your contract, has it been your practice to make considerable numbers of each of the different parts of the skates, and keep them until such time as you may desire to put them together?

A. We always have made those parts at the commencement of the year, as that is work we keep boys on to fill up time when we are doing nothing else.

Q. 26. During the period of time between the reissue of the patent and the filing of the bill, did you have on hand a considerable number of each of the parts constituting the clamping mechanism like that in Exhibit No. 1?

A. Yes; we always do have such parts in the factory.

Q. 27. Since that time, have you used any of the parts that you then had in store in the construction of skates substantially like complainant's Exhibit No. 1?

(Objected to as immaterial and irrelevant to any issue in this suit; and because the question ought to be limited to the time of the commencement of this suit, and counsel instructs witness not to state what he has done since that time.)

The design of these questions is apparent. They are put on the theory that, in a patent for a combination, he is an infringer who makes or sells only one or two of the parts of which the combination is composed, if done with the intent that the purchaser shall unite them with the other parts, procured either from the same or other sources, and at the same or at different times.

That seems to be the principle decided in Wallace *vs.* Holmes, (9 Blatch., 65,) on which the counsel for the complainant relies in support of his right to ask the question, and to call for the books of the defendants, exhibiting their business since the commencement of this suit.

In that case, where there was a patent for a new and useful improvement in lamps, which consisted of an improved burner in combination with a chimney, and the proof was that the defendants had manufactured and sold the burner alone, leaving the purchaser to supply the chimney—without which the burner was useless—the late Judge Woodruff held that the manufacture and sale of the burner by the defendants without the chimney was an infringement of the patent.

It cannot be (he says) that, where a useful machine is patented as a combination of parts, two or more can engage in its construction and sale, and protect themselves by showing that, though united in an effort to produce the same machine and sell it, and bring it into extensive use, each makes and sells one part only, which is useless without the other, and still another person, in precise conformity with the purpose in view, puts them together for use. If it were so, such patents would indeed be of little value. In such case all are tort-feasors, engaged in a common purpose to infringe the patent, and actually by their concerted action producing that result. * * * * Each is liable for all the damages.

Without thereby intending to intimate an ultimate opinion in regard to its relevancy to the pending one, I propose to adopt its spirit in the order which I shall make on the present motion.

Let the subpœna *duces tecum* be modified as the defendant requests, by inserting the clause "and until the commencement of this suit" after the words and figures "6th day of April, 1875;" but at the same time let the defendant, and any other witnesses, answer question 27, and all other questions tending to show the subsequent use of any of the parts of skates like Exhibit No. 1, which defendants had on hand when the suit was commenced.

This order is made upon the supposition that the answer to question 27 will serve the purpose of complainant as to present proof. If the evidence as to the fact of what the defendants have done since the commencement of the suit in the matter of uniting the constituents of the combination should not be satisfactory to the complainant, and it is supposed that the book of the defendants will shed more light on the subject, the court will hear an application hereafter, on notice to defendants, in regard to exhibition of the books of account.

[*Charles F. Blake* for complainant.
J. Van Santvoord, for defendants.]

NEW BOOKS AND PUBLICATIONS.

TINNITUS AURIUM, OR NOISES IN THE EARS. By Laurence Turnbull, Ph. G., M.D., Physician to the Eye and Ear Department of the Howard Hospital, Philadelphia, Pa., etc. Second Edition with Cases. Philadelphia, Pa.: J. B. Lippincott & Co.

Dr. Turnbull sends us a very readable and interesting pamphlet on a very common and little understood malady. He shows that noises in the ears are the effects of causes widely different, and that sometimes the sounds are merely hallucinations, produced by abnormal action of the cerebral organs. Many remarkable instances of tinnitus are cited, and serve to render the book of value to the medical profession.

BRIDGES AND TUNNEL CENTERS. By John B. McMaster. Price 50 cents. New York city: D. Van Nostrand, 23 Murray street.

SAFETY VALVES. By R. H. Buel, C. E. Price 50 cents. New York city: D. Van Nostrand, 23 Murray street.

These two excellent volumes are Nos. 20 and 21 of Mr. Van Nostrand's Science Series. The work on safety valves is especially commendable for its clearness and accuracy, and such a work, judging from our multitudinous correspondence, has long been needed in our workshops and factories.

ADVENTURES OF A DEAF MUTE. By W. B. Swett. Marblehead Mass.: Published by the Author.

An interesting and well written account of some journeys and adventures in the White Mountains, the profits from the sale of which are devoted by the author to the benefit of his brethren in affliction.

THE ORIGIN OF LIFE AND SPECIES, a New Theory. By J. B. Pool. Price 10 cents. Pittsfield, Mass.: W. H. Phillips.

The author of this pamphlet deserves credit for courage in attacking a very large subject, and for the clearness with which he states his views.

THE GROCER. Volume I, No. 1. Published Weekly. Subscription $2 a year. New York city: The Grocer Publishing Company 163 Chambers street.

A valuable and well edited trade journal, replete with accurate information and original articles.

THE ILLUSTRATED ANNUAL REGISTER OF RURAL AFFAIRS FOR 1876. With 170 Engravings. Price 90 cents. Albany, N. Y. Luther Tucker and Son.

An excellent handbook of agricultural and gardening matters, accompanied by a calendar and much useful information.

AURORA BRAZILEIRA is the name of a new monthly scientific and mechanical periodical, published in the Portuguese language by Mr. J. C. Alves Lima, at Syracuse, N. Y. The journal is intended principally for Brazilian circulation, and as a medium for trade between the United States and the Portuguese-speaking population of South America. The first number before us is well illustrated, and contains an interesting variety of articles. The subscription price, 10,000 reis, is somewhat startling unless one appreciates the minute unit of Brazilian money, and translates the total into $5.45 United States currency.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From December 3 to December 16, 1875, inclusive

ARTIFICIAL LEATHER.—A. W. Pope (of Boston, Mass.), London, Eng.
BOOT SEWING MACHINE.—D. Mills (of Brooklyn, N. Y.), Aston, Eng.
BUILDING SHIPS.—T. H. Buckler, Baltimore, Md.
CHECK FOR FIRE ARMS.—W. D. Miller, Pittsburgh, Pa.
CLOTHES HORSE, ETC.—C. T. Rowe, Brooklyn, N. Y.
GRINDING BARK.—S. R. Thompson *et al.*, Portsmouth, N. H.
LOCK NUT, ETC.—P. M. F. Casin, Colorado.
METAL CAR FRAME, ETC.—B. J. La Mothe, New York city.
ORE-ROASTING FURNACE.—R. M. Fryer, New York city.
PREPARING PAPER FOR PRINTING.—R. M. Hoe, New York city
REPEATING FIRE ARM.—B. B. Hotchkiss, Paris, France.
SHIP'S TABLE.—E. P. S. Andrews, Havilah, Cal.

Recent American and Foreign Patents.

NEW HOUSEHOLD ARTICLES.

IMPROVED CLOTHES LINE PROP.

Christian C. Schwaner, Winterset, Iowa.—The upper ends of the prop pieces are slotted for the purpose of forming a groove, for retaining the clothes line, which is stretched across the props in any suitable manner. The legs of props may be spread to bring the line down to the convenient altitude for fastening the clothes thereon.

IMPROVED SAD IRON.

Albert L. Parcelle, Oneonta, N. Y.—The handle is provided with one rigid hooked standard and one jointed standard, the hook terminating the lower part of the latter. The hooks enter eyes on the back of the iron, and are bound by moving a cam on the jointed standard.

IMPROVED BREAD CUTTER.

Maurice Walsh, Sillery Cove, and Maurice Abearn, Ottawa, Canada.—This device includes a knife frame, provided with a projecting arm engaging in the notch or fork of the pivoted swinging gage piece, for lifting the same out of the way, to allow a removal of the cut pieces. The downward or cutting stroke of the knife throws the gage out of the way for dropping the slice in the basket or other receptacle. The invention has been entered for exhibition at the Centennial.

IMPROVED PROCESS OF PRESERVING FRUIT.

John F. Bassford, New York city.—This invention consists in preserving fruit by mixing water and starch with the fruit when in the form of preserves. The seeds, pits, or stems are removed, and the fruit is put in a kettle, and sugar added, according to the tartness of the fruit. The fruit and sugar are then boiled for fifteen minutes, more or less, and to one quart of the preserved fruit is added one quart of water, and the whole is brought to a boil. An ounce of starch is then added to each quart of the diluted fruit, the starch being first wet in enough cold water to reduce it to a thin paste. The mixture is then stirred for two or three minutes, to thoroughly mix it, the stirring being continued until the foam disappears. The fruit is then ready for use when cold.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED PAPER DRYING MACHINE.

Culver S. Clark, New York city.—This inventor aims to provide for paper manufacturers an improved machine for drying sized and unsized paper in a rapid and superior manner. He proposes suitably arranged casings, through which the continuous sheet of paper is conveyed by feeding and carrying cylinders made of open rods, to expose the paper at top and bottom sides to hot air drafts thrown thereon from blowers or fans in the same direction in which the paper is traveling. The continuous action of the air blasts on both sides of the wet paper traveling through the casing produces the even and uniform drying of the same. The air blasts also assist the easy forward motion of the paper over the carrying cylinders, and prevent any sticking of the paper thereon.

IMPROVED SAFETY AND RELIEF VALVE.

John William Meiling, Birkett Bank, Wigan, Eng.—In ordinary safety valves, the lift, and consequently the orifice for the escape of steam, is very limited, more particularly with high pressures. The present invention aims to obviate this defect by making the valve and seat with two faces, and by exposing only a part of the area of the valve to the pressure of the steam when the valve is closed. When the blowing-off point is reached and the valve is slightly raised, the steam escapes in the ordinary way through one of the faces, and is admitted under the other face, thus acting on a greater area. The steam that is admitted under the second portion of the valve is allowed to escape through a hole in the valve.

IMPROVED GAGE ATTACHMENT TO WOOD BORING MACHINES.

George S. Hudson, Ellisburg, N. Y.—This is an improved gage, which is adjusted upon the bed of an ordinary horizontal boring machine into the exact position to the bit required by the work. A block slides in either direction from the center of the back piece of the table, through whose central aperture the bit passes, and is held in position by a double spring pawl, which engages either adjustable lugs or rack teeth, according as the holes are to be made at irregular or variable distance from each other. The stuff is fed in accurate manner to the bit or auger, and thereby a superior fit at a saving of time and labor obtained.

IMPROVED SAW GUMMER.

John W. Parker and Thomas Parker, Chicago, Ill.—This is an improvement in the class of gummers whose cutter shaft bearing is adjustable in a slotted way, which is in turn adjustable around a fixed axis located on a lower portion of a circular frame that is provided with clamps to adapt it for attachment to a saw blade. The novel feature consists in means for automatically interrupting the feed of the cutter shaft and producing reciprocation of the same simultaneously with its rotation.

IMPROVED VIBRATING PROPELLER.

John D. Cornell, Jersey City, N. J.—This inventor proposes two sets of paddles, carried on pivots at their upper ends in horizontal frames, located under and partly in the bottom of the vessel between two keels. They are carried backward and forward by cranks. The paddles swing up nearly horizontal, and move partly edgewise against the water when going forward, and swing down vertically and move sidewise against it when going back. This is claimed to give the necessary area of propelling surface, with much simpler apparatus than the common paddle wheels and screws.

IMPROVED LINING FOR MACHING BEARINGS.

Lebbeus W. Lathrop and Theodore A. Weber, New York city.—This is an anti-friction cloth, either canvas, silk, or any other woven fabric, or paper or skins. Upon it is spread an even covering of anti-friction material composed of graphite and sugar, and the sheets so covered are passed between compressing rolls, the upper one of which is heated sufficiently to soften and spread out, and at the same time condense and unite the compound, and press it on or into the sheets to effect the requisite adhesion. The sheets are then used as linings for bearings.

IMPROVED UPRIGHT TUBULAR BOILER.

Nathan C. Heaton, New York city, assignor to Ward B Snyder, same place.—This relates mainly to a cap for an interior boiler and its casing, which cap is attached by a screw-threaded flange. An illustration of the boiler will be found on page 371, volume XXXIII.

IMPROVED VALVE INDICATOR.

John S. Wallace, Brettland, O.—This inventor proposes a stem connected to the valve and projecting out through one end of the steam chest, and carrying a pointer along an indicator scale, by which to set the valve without opening the steam chest.

IMPROVED ADDING MACHINE.

Dennis L. R. Butt, Pilot Point, Texas.—This is an ingenious combination of a toothed wheel with suitable mechanism, by adjustments of which sums in simple or compound addition may be quickly calculated.

IMPROVED RAILROAD RAIL.

George H. Mayer, Jr., Shamokin, Pa.—This relates to an improved railway rail that may be relaid without drawing a single spike, preserving thereby the cross ties and producing a saving of iron. It consists of a base rail with top rail resting on a square seat at the side, and overlapping the curved top of the same, to be retained thereon by fastening bolts and nuts.

IMPROVED FLOCK-WASHING MACHINE.

Asa C. Russell, Great Barrington, Mass, assignor to Parley A. Russell, same place, and Clinton H. Blake, New York city.—This is an apparatus for separating the flock from the water as it escapes from the washer, and preserving the flock, while allowing the water to flow away. It is formed of an outer box, made with an open top, and provided with a discharge opening at its bottom. There is an inner box, made smaller than the outer box, with open bottom and top, supported with its lower edge a little above the bottom, and its upper edge a little above the top of the said outer box, having the space between it and the outer box at one end separated from the spaces between the sides of said boxes. There is also a screen at said end, in combination with the discharge spout of the washer.

IMPROVED MACHINE FOR FINISHING HORSESHOE NAILS.

Harry A. Wills, Chicago, Ill., assignor to Julia A. Wills, same place, and Lucy S. Kingsland, Burlington, Vt.—In order to return the sheared blanks from the shearing die into the carrier again, to be afterward carried to point-beveling dies to be beveled, a pusher or follower is provided, in connection with the shearing die, which follows close behind the punch when it withdraws, and pushes the nail immediately after it is sheared back into the notch of the carrier. In order to prevent the blanks from turning in the trimming die, or while moving from or back into the carrier, another new feature is added in the shape of a little vibrating guider, with a slot on the under side, so arranged that, just before the blank comes to rest in front of the shearing dies, the head will pass into the slot, which will hold the blank from turning.

IMPROVED SCREW CUTTING DIE.

Virginius J. Reece, Greenfield, Mass.—This invention consists of a die which has a spreading pin inserted at the split part of the circumference, and an adjusting screw passing through the edge of the die to bear at right angles on the pin. The one adjusting screw and pin takes the place of four set screws heretofore used, so that the number of screws and die holders is reduced, and thereby the cost for die stock and die diminished.

IMPROVED HORSESHOE CALKING VISE.

William Weaver, Greenwich, N. Y.—This relates mainly to a new arrangement of a cam, which connects with a treadle and serves to lock the vise. The invention is strong and simple in construction.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WHIFFLETREE FASTENING

Hannibal R. Jackson, La Fayette, Ind., assignor to himself and Thomas J. Roads, same place.—This is a new way of detachably fastening the whiffletree of vehicles to the double tree; and it consists in a plate having a rearwardly opening T-shaped groove, with enlarged end, in combination with a second plate attached to the whiffletree, having a pivot provided with a head.

IMPROVED FIRE PLACE.

Robert Thompson, Stapleton, N. Y.—A forward-projecting angular part or shelf of the wall, made of bricks or metal plates, forms, in connection with the front wall, an air chamber, which is supplied with cold air by suitable air flues from the outside. The apex of the angular rear wall is below the angle of the fire wall, and approaches close to the same, so as to form a narrow air flue, that connects the lower part with the upper part of the air chamber, and throws, by the lower inclined part of the shelf, the cold air directly on the heated fire plate.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED BAG FASTENER.

Charles W. Harvey, Waterloo, Iowa.—The invention relates to a mode of securing the end of a bag's string fastener without making a tie, the latter being liable either to work loose or draw into a knot, thus occasioning waste of contents or loss of time. The invention consists in loosely journaling upon a screw bolt a pair of stiff metallic disks, inclined and adjustable toward each other, one being placed on the inside and the other on the outside of the bag. The string is thus held by its own compressibility between the bag and outer disk.

IMPROVED SHAVING CUP.

Philipp Schauble and Louis Dohm, Elizabeth, N. J.—In order to hold the soap in shaving cups so that it will not come out when the cups are washed, the above inventors propose making a screw thread in the lower part of the cup, and a similar thread in the soap. The soap can then easily be screwed in place by a simple key.

IMPROVED NECK TIE FASTENER.

Johann Waehner, New York city, assignor to Daniel Richter, of same place.—This device has a hook at one end for catching over the collar band. The other end is arranged to pass through holes in the neck tie, bend over, and, by being pressed back, fasten thereto. In the center is a coiled spring to give the requisite elasticity. The three portions may be worked out of one piece of metal without break.

IMPROVED COMBINED CLEAT AND HAWSER CLAMP.

Ferdinand W. Hofele, New York city.—In docking a vessel it frequently happens that the full length of a hawser is let run out because a sufficient hold cannot be had as it nears its end; and to obviate this difficulty, this inventor has constructed a cleat, having a clamp set within it, by which the end of the hawser may be griped and held secure until released by the person in charge.

IMPROVED FENCE.

William A. Couch, Hannibal, Mo.—This relates particularly to the construction of a detachable batten to the panels of the fence, which may be readily detached by simply turning buttons to a position parallel to the rails.

IMPROVED WIRE FENCE BARB.

Henry N. Frentress, Dunleith, Ill.—This consists in barbs formed by cutting thin sheet metal into diamond form, slitting them from the acute angles nearly to the center, and bending the prongs at each end at an angle with each other to adapt them to be twisted into a two-strand wire cord.

COMBINED TWINE CUTTER, LETTER OPENER, AND STAMP MOISTENER.

John Eitel, Sacramento, Cal.—The invention consists of a pair of small scissors, which are protected within an operating guard spring, to which, also, a spring device for attaching it to the ball of twine, a letter-opening knife, and a pivoted sponge holder, for moistening the stamp, are applied.

IMPROVED ABDOMINAL CORSET.

Cathrine A. Griswold, New York city.—This is an improved abdominal corset, which combines, with a perfect fit, a comfortable support for the abdomen, so as to relieve the same from any strain or drawing, and throw the weight of the same on the shoulders.

IMPROVED MARINERS' LOG.

George E. Elliott, St. Andrews, Can.—This is an improved mariners' log, which registers correctly the speed of a vessel without requiring any particular skill in its use or special calculations. It consists of a concave disk or drag, that acts with greater or lesser force, according to the speed of the vessel, on a rack bar and spring, which moves, by suitable actuating gearing, the index hand along a face dial. The index hand is retained by a ratchet and pawl, for reading off the log, and returned to its position by a tension spring on releasing the pawl.

IMPROVED LIFE PRESERVER.

Beall Hempstead, Little Rock, Ark.—This life preserver is made of wood, in sections, connected and hinged to each other by rubber strips, and provided with a rubber band around the waist, and with rubber strips around the neck, waist, and arm holes.

IMPROVED BASE BALL BASE.

John C. O'Neill, St. Louis, Mo.—This is a case or box, with sockets for elastic columns that support a cap plate, having corresponding sockets. The fact of the runners having touched the base is announced by the sound of a bell, caused by the depression of the cap plate.

IMPROVED VENT.

Edward R. Behlers, St. Louis, Mo.—This is an improved vent that is closed perfectly airtight at all times, but supplies air as soon as the faucet is turned. It consists of a rubber tube, which is supported by an interior spiral spring, and fitted, by a perforated closing knob, into a receiving tube, that communicates by a downward extending tube driven into the bung or barrel with the interior of the same. A slit in the rubber tube, above the connecting tube, supplies the air on opening the faucet, closing airtight on shutting the same.

IMPROVED AUTOMATIC LIGHTER FOR GAS BURNERS.

Henry B. Stockwell and Albert R. Weiss, Brooklyn, N. Y.—This invention consists in the connection of the gas cock with a ribbon-feeding slide piece, and a spring hammer operated thereby. The burner socket, magazine guide, and anvil are cast of one piece, to which the fulminate ribbon, slide piece, and hammer are applied, so as to feed the ribbon, and ignite, simultaneously, one of the pellets by the opening of the gas cock.

IMPROVED ORE CONCENTRATOR.

John Longmaid, Bingham, Utah Ter.—The object of this invention is to separate ores from worthless substances with which they may be mixed, by causing such minerals, in a finely powdered condition, to flow, by means of water, over a large revolving table, fixed at a certain inclination, and washing the same by means of a thin sheet of water, and finally discharging the washed ore at the lower portion of the table by means of jets of clean water.

IMPROVED FAUCET.

Willis L. Brownell, Brooklyn, N. Y.—In this faucet a valve acts upon a cam portion of a lever shaft in such manner that the latter is turned automatically when the lever or handle is relieved of (hand) pressure, thus allowing the valve to close tightly on its seat. There is also a short rigid tube to deliver the water into the hollow valve, and to act as a support or guide for the same when open, and a new arrangement of combined stop and packing disk on the lever shaft.

IMPROVED REIN HOLDER.

George W. Miller, Constitution, Pa.—This is an improved rein rest for attachment to the dashboard of vehicles, so constructed as to prevent the horse from throwing his tail over the reins, and to prevent the reins from falling to the ground should they be accidentally dropped. It may be turned down out of the way when not required for use.

IMPROVED HARNESS SADDLE.

John W. Schwaner, New York city.—This relates to an improved construction of wrought iron harness saddles. The new features are a wrought iron bed plate, cut out into proper shape, struck up into proper form, and provided with holes, strengthening corrugations, and recesses for the back band loops; a wrought iron seat plate cut out into proper shape, struck up into proper form, and provided with the strengthening rib and other arrangements, in combination with the bed plate; and salient angles formed upon the side edges of the seat plate, to be bent down over the side edges of the wooden seat block.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CORN UNCOVERER.

Hugh H. Gilchrist, Swan Creek, assignor of one half his right to John J. Worden, Youngstown, Ill.—This consists of a plate which is to be attached to the sole of the plowman's shoe, and which carries a bar having several prongs or fingers. This arrangement enables the plowman to uncover the corn that has been covered or partly covered by the soil thrown by the plow or cultivator, and straighten it up, freeing its leaves from the soil.

IMPROVED GANG PLOW.

Timothy M. Shaw, Lebanon, Tenn.—In this device are the following new features: First, a frame composed of two curved beams, each provided with a shovel or plow, and adjustably connected at their front ends, so that one shovel or plow may be set in rear of the other. Second, said frame is provided with handles, which are adjustable correspondingly with themselves. Third, the beams and handles are connected by two sets of transverse parallel bars, made separately adjustable as to length, and connected to said beams and handles by means of universal joints or couplings. The result of this combination and arrangement of parts is that the handles may be adjusted so as to remain opposite each other, and the plow beams will at the same time be held rigidly connected whatever be the adjustment of the plows, whether in gang or one or both inclined from a vertical, to take more or less into the side of ridges, while cultivating between the rows of growing crops.

IMPROVED RICE MORTAR.

Nathaniel O. Tilton, Savannah, Ga.—This rice-cleaning machine has a reciprocating pestle, and is used for separating the thin skin or film which remains on the grain after the hull or rough outside shell has been removed. The new feature is an open centrically located ring, which gives increased friction, and causes the rice to clean in less time.

IMPROVED CHURN DASHER.

John R. Underwood, Nelsonville, Ohio.—On the dasher shaft are two sets of bars, arrayed radially to the axis of the shaft and placed one above the other. The lower sides of the bars are concave, so that when the dasher is forced down the bars enter the milk with the recesses filled with air, and the air and milk are forced out through holes in the sides of the bars toward the sides of the churn throwing the milk into violent agitation, and bringing the butter in a very short time.

Notes & Queries

X. is informed that no one is entitled to make, for his own use, an article that is patented. The right to sell patented articles in a certain territory depends on the agreement which the agent has made with the patentee.—J. F. W. will find a recipe for lemon sugar on p. 378, vol. 30.—R. B. will find good directions for making an aquarium on p. 80, vol. 31.—N. F. will find a recipe for gutta percha varnish on p. 379, vol. 30.—J. N. will find a description of the physiological and pathological properties of alcohol on p. 91, vol. 31.—W. H. K. will find an illustrated description of the gyroscope on p. 91, vol. 31.—W. M. will find good directions for building a cistern on p. 91, vol. 31.—F. W. can straighten his gun barrel by the process described on p. 107, vol. 31.—N. S. B. & Co. will find, on p. 43, vol. 33, a good recipe for aquarium cement.—R. K. will find a good recipe for preserving timber on p. 265, vol. 33.—G. G. B. will find a good recipe for blacking for patterns on p. 409, vol. 33.—J. C. L. is informed that his queries as to currency are not in our line. Many saws are made entirely in this country; same very large ones are made from steel plates made and forged in England.—A. D will find directions for preserving eggs on p. 219, vol. 31.—E. T. A. will find directions for producing verde bronze on brass on p. 283, vol. 31, and for an Etruscan color on jewelry on p. 363, vol. 33.—C. W. E. will find a prescription for boils on p. 379, vol. 24.—S. Z. R. will find a description of a method of wire transportation on p. 370, vol. 31.—L. D. will find directions for black enamel on iron on p. 208, vol. 26.—A. R. S. will find directions for melting brass in small quantities on p. 203, vol. 33. An average brass melts at 1750° Fah.—S. S. B. will find directions for staining common wood in imitation of black walnut on p. 337, vol. 33.

(1) A. B. H. asks: What will cause aniline colors to penetrate furs, felt, etc.? A. The great affinity that woolen materials have for all the aniline colors, we should think, would render the dying of even very fine felt a not difficult matter, if properly managed. Where a delicate shade is required, the fibers are sometimes dyed before matting. In any case the material should first be properly cleansed.

(2) W. S. W. says: I have read of drowned persons being found by putting mercury in pieces of bread and letting them float on the water in which the bodies were supposed to be. The bread floated till it came over the bodies and then sank, it being supposed that the mercury was attracted by articles of gold jewelry on the bodies. Is this so? A. The statement is not true. The most delicate instruments have failed to determine the existence of any attraction between the two metals, save the force of chemical affinity which acts between the molecules at extremely minute distances. This also answers several other correspondents.

(3) T. Y. asks: What liquids (besides acids) will absorb or dissolve sal ammoniac in crystals? A. Water.

(4) G. W. D. says: In the manufacture of raisins by artificial processes, the grapes are dipped in a strong, hot solution of concentrated lye, which opens the pores, or cuts the skin, so that the moisture can pass off freely in the evaporating chamber. Such preparatory treatment, however, leaves on the raisins an alkaline taste, which is objectionable. Can you suggest some other method by which the skin of the grape can be opened or softened for the purposes named, without injury to the flavor? A. In the preparation of raisins for the market, this and similar processes seem to be employed almost universally. In cases such as you mention, where the taste of the raisin has been impaired by such treatment, we should recommend the trial of some method that will tend to neutralize or destroy the objectionable flavor, such as dipping for a few moments into a solution of citric or tartaric acid in water, washing in clean water, and finally re-drying.

How can I remove the oil from salmon, preparatory to drying same, so as to overcome the tendency to rancidity? A. We do not know of any method by which all the oil may be removed and the fish remain intact. The tendency to rancidity might be overcome by steeping the fish for a short time in a solution of some harmless disinfectant, such as salicylic acid or iodate of calcium.

(5) C. P says: I poured some clean water in a tumbler, and then some kerosene oil, when the water remained on the bottom. On adding common whitewash and stirring the whole mixture, the lime sunk to the bottom, then came a layer of water, then a layer of spawn like matter, then clear kerosene. What was the spawn-like matter? A. Probably a mixture of water and oil, in which case, if allowed to remain quiet for a short time, it would separate, and a distinct line would mark the surface of contact between the two liquids. You should have stated what, besides lime and water, the whitewash contained, if anything.

(6 F. X. M. says: 1. It is said that muddy water will freeze into clear ice. If that is the case, at what point does the clarification commence? It is evident that water may be very cold, and yet remain muddy, so that it must be at the freezing point: it is certainly not after the ice has formed. A. Water, on freezing, does purify itself from all foreign matter provided the latter be not in too great excess, in which case the rejected impurities may become entangled between the fast forming crystals. This self-purification probably takes place at the moment of crystallization. 2. In building an ice house, what cheap substance is best for filling between the walls? A. Use good charcoal, finely crushed. 3. What advantage is it to a cooking stove to feed the fire with air heated to 300° instead of supplying it directly from the apartment, at 50° to 70°? A. A slight saving in fuel.

(7) J. W. S. says: Please give me a good recipe for making green paint for window blinds. A. An excellent pigment for this purpose consists of chrome green (hydrated oxide of chromium) ground in oil and tempered with white lead and sometimes barytes (sulphate of baryta).

(8) E. R. says: I am making a pulse tester. I have a very light glass tube, with a ball at one end. It is half filled with alcohol; and in order to expel the air, I boiled the alcohol, and then closed the tube by the spirit lamp, but it does not work satisfactorily. If I mix a little liquid carbonic acid with the alcohol, would there be any danger of explosion in case the tube should break? A. It requires some care and practice, as well as some previous knowledge of the requirements of the case, in order to satisfactorily construct these little instruments. Carbonic acid is not suitable for the purpose, and there is danger in using it.

(9) H. S. asks: How much would a steam boiler, made of copper $\frac{1}{16}$ inch thick, of a cylindrical form, 18 inches in diameter, and 13 inches deep, stand? A. About 15 lbs. 2. What part of a horse power would such a boiler give, if kept boiling? A. We cannot tell you, as there is no rule for it.

(10) A. E. R. says: In warming a shop with exhaust steam, shall we get more heat by closing the drip pipe cocks so far that nothing but water will come out, thereby letting about half the exhaust steam into the air through the exhaust pipe, or by opening the drip pipe cocks and letting all the exhaust steam through the heating pipes? A. By the latter method, as we understand the question.

(11) W. W. L. says: I wish to build a boat to go up the rivers of Texas. There will be four men, with the necessary baggage for a hunting expedition. We want a small cabin, and the boat should be so constructed as to run about 5 miles an hour. What should be the dimensions and shape? What power of engine will be required? What should be the size and pitch of propeller? Would side wheels do as well as a screw? She should not draw over 1 foot of water. A. You can make a boat 30 feet long, and 5 or 7 feet wide, and use an engine 5x6 inches, and a propeller 32 inches in diameter and of 4 feet pitch.

(12) J. E H. says: 1. Given a small steam boiler containing naphtha instead of water. If heat is applied, will the hydrocarbon vapor that is formed have the same behavior as steam, and will a steam gage indicate the pressure in the boiler as if it were steam? A. Yes, unless the naphtha is more volatile than water. 2. If naphtha be used for some time, as in the above case, will there not be a thickish deposit in the boiler, which will be require to be cleaned from time to time? A. Generally, yes.

(13) J. B. W. says: I put a lightning rod on my dwelling; area of roof is 2,000 feet. Rod is made of copper about $\frac{1}{16}$ inches in diameter. I led the end of it into a bed of about half a barrel of iron turnings, not spread out into large surface but tumbled into an excavation made for the purpose, and so arranged that the bottom of the mass of turnings was about 3 feet below the surface of the ground, and the top about 1 foot below, the rod running through the mass and some 5 feet into the ground. Now what I want to know is, if this conducting material and the manner of placing it is in accordance with your views of safety? If not, what can I do to remedy it? A. Your method of arrangement of rod within the conducting material at the terminal is correct; but your rod has the common defect, namely, its terminal in the ground is insufficient. You have 10 feet conducting terminal. You should have 2,000 feet. The rule for dry soils is to have for the terminal of the rod, underground, an area of conducting surface equal to the roof area. Your roof area is 2,000 surface feet. You should therefore have a conducting surface of 2,000 feet for your rod terminal. Charcoal is an economical material for the purpose. A trench 400 feet long, 18 inches wide, 5 feet deep, with a layer of charcoal on the bottom 9 inches deep, firmly compacted, and the rod extended along the whole length of the trench, in the center of the charcoal, will give you a reliable terminal. The joints of the rod should be welded, or soldered and firmly bound, so as to make the rod, practically, one continuous piece of metal.

(14) H. F. K. asks: I am desirous of heating my shop by live steam. Can you give a rule by which I can know the boiler capacity requisite for every 100 feet of radiating surface in my pipes? I wish to rate the boiler low enough to secure a fair economy of fuel. A. You do not send sufficient data; but by applying to a reliable boiler maker, and giving him full particulars, you can doubtless ascertain the proper proportions.

(15) A. M. says: My flouring burrs are running on very hard spring wheat; and they sweat badly and gum up everything near them with dough. How can I prevent this? A. We do not know of any remedy except waiting for the wheat to dry, if your stones are properly dressed. If any of our readers can aid you, we would be glad to hear from them.

(16) W. R. C. asks: 1. Can I locate a boiler 100 yards from the building containing the engine, and can I, by laying underground a tube, properly protected, run the engine? Will there be much loss of steam? A. Lay the pipe in a box and pack sawdust or other non-conducting material around it; and put in a good trap to carry off the condensed water.

(17) W. I. Co. say: We have a large vein of magnetic iron ore, but it has an access of top water. By making a cross cut tunnel or adit, 600 feet in length through soft ground (which requires timbering), we can cut the vein at 50 feet under the surface for a water adit, and save the pumping of the water to the surface from that depth. What is the customary adit grade in Cornwall and other parts of Europe, and in America? Of what grade are the railroad tunnels in America and in the Alps, that carry off their top water? A. The grades vary considerably, from 0 67 feet in 1,000, where a very slow current is desired, to 1 in 400.

(18) W. M. D. says: I am building a small engine, 2⅝ by 5 inches stroke. My boiler is 30 inches long, internal diameter 17 inches, made of boiler plate $\frac{5}{16}$ inch thick. Would cast iron heads do? Of what thickness should they be? Will 6 one inch flues be sufficient? What pressure will it be able to carry? A. It would be better to use wrought iron heads. Get in as many tubes as you can without corroding. If your boiler is well built, it should sustain from 130 to 140 lbs. per square inch with safety.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. A. B.—A variety of magnetic oxide of iron.—W. H. G.—It is decomposed spar, and consists of silex, alumina, and carbonate of lime, which constitute the chief part. It does not necessarily indicate the presence of metal. There are many localities of tin ore in the United States, but no genuine tin mines. Tin is usually associated with fluor, apatite, topaz, blende, wolfram, etc.—N. W. D.—No. 1 is a rock composed of calcite, chondrodite in grains, and traces of serpentine. There is no reason for rejecting the determinations of the professional assayer. No. 2 consists of hornblende, quartz, felspar, and muscovite, and the silver may be taken as the assayer has determined.

J. R. A. asks: How can I cure and prevent cracked heels in horses?—J. L. asks: How is oatmeal manufactured?—R. H. B. says: The general impression is that the rainbow is literally a bow. Has any one ever seen the complete circle of a rainbow, which of course can only be seen from a balloon?—B. B. asks: Will it damage flax straw for manufacturing purposes to thrash it with a common spike cylinder thrashing machine?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Chemistry on a Mathematical Basis. By E. V.

On the SCIENTIFIC AMERICAN'S Publications. By J. M. R.

On Mr. Edison's Discovery. By N. P.

On a New Form of Chair. By C. M. A.

On the Hydro-Pneumatic Puzzle. By W. H. C.

On the Speed of Pulleys. By J. B.

Also inquiries and answers from the following:

F. B. S.—R. B.—J. T.—S. N.—F. H.—C. E. H. Jr.—P. S.—W. H.—W. S. D.—C. B. L.—R. Y.—J. G.—A. A. E. R. McG.—A. A. M.—A. J. C.—R. C.—W. L. G.—E. H.—A. J. M —J. H. H.—W. D.—A. S. C.—B. P.—J. D.—H. B. P.—C. J. T.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells the best permanent magnets? Who makes the best traction engines? Whose is the best machine for mitering picture frames?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

December 21, 1875.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Anti-incrustation compound, L. N. Lye	171,397
Axles, setting metal, F. Box	171,343
Bale tie, P. K. Dederick	171,315
Bale tie, R. Montfort	171,302
Barrel, A. Wyckoff (r)	6,814
Barrel headings, baling, J. Keppie	171,329
Barrel machine, A. Wyckoff (r)	6,813
Bee hive, D. Cox	171,314
Belt tightener, O. Cooley	171,354
Bird cage feed cup, Osborn & Drayton	171,309
Bit stock, angular, J. W. Anthoine	171,295
Boiler, steam, J. Shackleton	171,436
Boiler and pipe covering, J. C. Reed	171,425
Book and music support, L. Berg	171,260
Book-backing machine, J. E. Coffin	171,306
Boot-nailing machine, McKay & Fairfield	171,300
Boot-pegging machine, W. D. Orcutt	171,414
Boot jack, I. Massie	171,398
Bottle stopper, T. W. Murray	171,410
Bottle stopper, S. S. Newton	171,304
Bottling mineral water, etc., J. B. Newbrough	171,340
Boxes, corner joint for, G. S. Sterns	171,326
Braces and suspenders, H. S. Archer	171,507
Bracket for shelves, M. D. Jones	171,326
Brick machine, E. L. Wagner	171,453
Bridge, iron truss, F. Schememann	171,323
Buck board, C. Neligh, Sr.	171,412
Burner and generator, gas, A. G. Griffin	171,278
But on, sleeve, G. A. Allen	171,254
Buttons, manufacture of glass, I. & G. Lehmann	171,294
Calendar, J. Keller	171,327
Calendar, C. Z. O'Neill	171,308
Can opener, G. L. Witall	171,463
Can, powder, F. F. Egge	171,264
Can receptacle, milk, N. Littlefield	171,294
Candy heater, steam, B. & H. Stern	17 ,444
Car brake and starter, W. Scott	171,246
Car coupling, E. P. Harrington	171,280
Car coupling, Klingler, Bolender, and Stem	171,289
Car dumping apparatus, J. Wiland, Sr	171,460
Car, sleeping, J. L. Mitchell	171,338, 171,339
Carpet linings, making, W. Lewis	171,292
Carpet stretcher, L. Nolton	171,307
Carriage, child's, Galt & Blaisdell	171,270
Carriage wheel, E. Brown	171,348
Carriage stay end die, D. Wilcox	171,467
Cartridge, blasting, Smith & Egge	171,441
Chair, dental, E. T. Starr	171,443
Chair, folding, P. Born (r)	6,815
Chair seat, P. Buckley	171,312
Check box and cash indicator, W. I. Ripley	171,344
Churn, D. M. D. D. Brown	171,265

Churn, J. Watson	171,361
Clasp, J. Perkins	171,314
Cock, stop, J. G. L. Boettcher	171,344
Coke oven, E. S. Goblet	171,371
Cooking apparatus, E. H. Murray	171,411
Cooking utensil, W. Lacy	171,231
Cooler, milk, N. D. Ferguson	171,219
Cooler, milk, I. H. Wanzer	171,351
Coop, folding, D. M. Sullivan	171,446
Cork for bottling beer, etc., C. Pfannenstiehl	171,315
Corpses, etc., preserving, J. Whelan	171,333
Cradle, treadle, J. A. Kirchner	171,398
Cultivator, J. Pierpont	171,420
Curry comb, Kellogg & Trussell	171,386
Curtain fixture, E. M. Judd	171,395
Dental hammer, J. C. Dean (r)	6,817
Desk, school, J. A. Dole	171,272
Digger, potato, Heydemann & Klinkmann	171,224
Distilling and rectifying, J. W. Reford	171,426
Dredger, rotary, A. Hawley	171,380
Drill and distributer, A. S. Wishart	171,461
Drills, chuck for metal, T. Hoppe	171,388
Drilling apparatus, well, D. H. Muir	171,406
Dryer, I. B. Cottrell	171,355
Eaves trough hanger, J. P. Abbott	171,253
Elevator, water, L. H. Thompson	171,330
Electroplating statuettes, etc., Worthen *et al.*	171,464
Engine, steam, J. S. Foster	171,275
Engine valve, pumping, L. J. Knowles	171,390
Envelope, R. S. Jennings (r)	6,820
Envelope, E. J. Nolin	171,406
Fabrics, creasing fluted, J. H. Brown	171,264
Fence, iron, F. O. Hanson	171,377
Fence, portable, I. W. Panconst	171,311
Fence, portable, H. Teil	171,329
Fence wire, barbed, F. Armstrong	171,208
File blank holder, J. Garland	171,277
Filter, packing, T. R. Sinclaire	171,439
Fire arm, breech-loading, E. C. & C. W. Sneider	171,442
Fire place, J. S. Lester	171,395
Fires, extinguishing, S. S. Newton	171,305
Fountain, hanging or portable, F. I. Shafer	171,437
Furnace, hot air, C. Clark	171,351
Furnace, hot air, T. F. Hemmich	171,281
Furnace, hot air, B. C. Sayre	171,431
Furnace metallurgical, E. Savage	171,321
Furniture spring, J. Flinn	171,369
Gage, pressure, J. Powers	171,317
Gas condenser, G. W. Edge	171,363
Gas meter, J. Morgan	171,407
Gas regulator, G. McMillan	171,396
Gas, treating natural, McElroy *et al.*	171,400
Glass furnace, J. Nicholson, Jr	171,241
Glaziers' points, cutting, J. M. Jay	171,286
Grain, storing and preserving, H. P. C. Lassen	171,290
Grave vault, W. C. Peckham	171,418
Guano distributer, J. T. Horton	171,285
Hammer, lifting device, C. O. Wilder	171,458
Harness pad, R. M. Selleck	171,324
Harrow attachment, F. D. Ladenberger	171,391
Harrow, convertible, Devoe & Mease	171,217
Head rest, Cushman & Cockburn	171,356
Heating drum, J. J. Hardenbrook	171,378
Hook, snap, C. Dudley	171,361
Hoops, shaving half round, G. B. Selden	171,447
Horn-polishing machine, C. B. Fish	171,220
Horse collar, J. Meyer	171,404
Horse-detaching apparatus, J. H. O'Brien	171,242
Horse power, F. Trulender	171,450
Horseshoe, Z. V. Purdy	171,421
Horseshoe machine, H. J. Batchelder	171,258
Horseshoe machine, D. I. Pruner	171,320
Hydrant, M. Allen	171,206
Hydrants from freezing, preventing, B. Kent	171,228
Ice machine, T. Cook	171,267
Ice tongs, N. P. Nelson	171,413
Index clip board, T. Orton	171,415
Indicator, electrical station, J. F. Kettell	171,397
Iron, cutting, Lakey & Mills	171,233
Journal bearing, G. Draper	171,359
Knife, corn stalk, P. C. Moore	171,308
Lamp filler, W. C. Cross	171,269
Lantern, signal, G. F. Pashley	171,417
Lathe for turning stone, S. L. & E. A. Beebe	171,259
Liquid packages, etc., filling, J. M. Hopkins	171,381
Liquors, aging, J. B. Baux	171,341
Loom shuttle guard, W. M. Parker	171,416
Loom take-up motion, J. Lyall	171,396
Mail bag, P. S. Thomson	171,250
Marking stamp, L. Ballinger	171,257
Mash attemperator, W. Paddon	171,310
Mat, spittoon, J. Lee	171,391
Measure, liquid, J. M. Hopkins	171,382
Mechanical movement, J. F. McCormick	171,399
Millstones, balancing, W. Gosshorn	171,373
Millstone driver, H. Wilhelm	171,459
Molding machines, pressure feet of, J. S. Loomis	171,296
Molding, dressing enameled, A. C. White	171,455
Monument, L. J. Milliman	171,405
Mortising machine, J. J. Berger	171,261
Mortising machine, S. Duck	171,360
Motor, spring, E. Shiver	171,438
Nail separator, I. N. Bumbaugh	171,213
Neck tie, G. G. Struhar	171,227
Nursing bottle, M. S. Burr (r)	6,809
Oiler, machinist's, O. J. Backus	171,339
Paper braid, J. W. Partridge	171,312
Paper collar blanks, cutting, A. Dewes	171,270
Paving block, W. F. Prentiss	171,318
Peat machine, A. E. Barthel	171,210
Photograph, carbon, C. L. Lambert	171,392
Pipe, drain and sewer, D. C. Sage	171,248
Pipe, water, E. W. Smith	171,440
Pipes, making veneer, R. M. C. Bross	171,346, 171,347
Pipes, trap for steam, C. A. Read	171,424
Planer, shingle, W. A. Kitts	171,230
Planing machine, surface, W. C. Margedant	171,397
Planter, corn, G. D. Haworth (r)	6,818
Planter, corn, Thomson and Ramsey (r)	6,821
Planter, corn, S. Wishard	171,462
Plow, J. Sewell	171,435
Plow, gang, J. B. McCormick	171,299
Plow, sulky, H. Ricnardson	171,427
Pocket safety attachment, D. Goldy	171,372
Press, C. H. Hersey	171,382
Press, cutting and punching, M. Von Culin	171,451
Presses, cotton and other, H. K. Burnett	171,349
Printers' leads, cutting, H. J. Stone	171,248
Printing inking apparatus, Potter and Hubbard	171,243
Propeller, steering, I. T. Payne	171,313
Radiator, steam, A. L. Ide (r)	6,810
Railroad track, street, I. Quigley	171,422
Rake handle, drag, Smith and Galbraith	171,235
Rake, horse, C. B. Perkins	171,419
Rake, horse, W. C. Raynor	171,423
Refrigerator, J. H. Wickes	171,456
Roll for rolling iron, J. H. Webster	171,454
Roof, sheet metal, C. W. Evans	171,368
Roofing slates, etc., trimming, E. R. Davis	171,358
Safe, provision, C. D. Harb	171,379
Sash fastener J. Bittenbender	171,267
Sash lift, J. Sweet	171,249
Saw handle, crosscut, E. C. Atkins	171,337
Saw set, G. N. Gove	171,375
Scoop, sugar, G. W. Woodward	171,252
Scraper, road, F. W. Schulz	171,433
Separator, clover, Metzger and Kohler	171,297
Separator, grain, L. W. Hasselmann	171,222
Sewing machine broom, H. Behren	171,342
Sewing machines, driving, R. H. St. John	171,445
Sewing machine ruffler, J. Bolton	171,263
Sewing machine thread guard, L. Roosevelt	171,428
Shingle edging machine, J. E. Austin	171,338
Shirt front, H. Converse	171,352
Shoe fastening, W. Edmister	171,274
Shoe fastening, W. J. McKee	171,301
Shutter fastener, J. Arnold	171,336
Sight protector, M. H. Mendenhall	171,403
Sled, bob, F. Dillon	171,271
Sleigh knees, manufacture of, W. H. Lloyd	171,295
Spikes, T. R. Timby	171,447, 171,448
Spinning machine, N. Marshall	171,298
Spittoon mat, J. Lee	171,291
Spool holder, J. J. Elliott	171,365
Stage scenery, G. P. Gordon	171,221
Stair rod, H. Iverson (r)	6,819
Steering apparatus, M. Townsend	171,449
Stove pipe joint, D. H. Klotz	171,389
Stove pipe shelf, G. Hilbirt	171,283
Stump extractor, Hart and Grove	171,379
Table, ironing, L. P. Lawrence	171,393
Table legs, fastening, W. K. Sawyer	171,322
Tallow, etc., treating, J. Tardos, Jr	171,328
Teaching drawing, device for, E. L. Crall	171,268
Telegraph, railroad, B. Cade	171,350
Telegraphic apparatus, T. A. Edison	171,273
Ticket, J. M. Savin	171,429
Tin scrap, utilizing, H. Frasch	171,276
Tire upsetter, G. D. Jacoby	171,225
Toy, dancing, B. D. De Forest	171,216
Toy gun, C. A. Pilinsky	171,316
Toy pistol, etc., E. Savoral	171,430
Trace fastening, Lake and McDevitt	171,232
Trap, fly, T. C. Dunn	171,362
Trap, fly, J. Parker (r)	6,811
Truck, W. A. Estes	171,367
Truck, Viall, Townsend, and Hill	171,451
Trunks, corner clamp for, W. B. Gould	171,374
Tube joint and coupling, G. Matheson	171,234
Tubes, etc., bending, M. McWilliams	171,402
Type wheel, G. H. Morgan	171,408
Type-writing machine, R. T. P. Allen	171,335
Upholstery, preparing fiber for, J. S. Cutter	171,357
Valve, hydraulic cushion, C. E. Emery	171,218
Varnish, Jenkins and Richards	171,384
Vehicle dash frame, M. Seward	171,434
Vehicle hub, D. O. Holman	171,284
Vehicle running gear, E. Booth	171,211
Vehicle running gear, J. W. Little	171,293
Vehicle spring, N. Provost	171,319
Vehicles, hand plates for, J. Jensen	171,287
Velocipede, A. Schmackers	171,432
Ventilator, T. W. Bracher	171,345
Ventilator, A. L. Moyer	171,409
Violins, chin rest for, H. W. White (r)	6,812
Wagon brake, O. T. Baker	171,340
Wagon spring, A. W. McKown	171,401
Wagon tongue caps, blank bar for, J. Jensen	171,288
Washing and wringing machine, W. Card	171,266
Waterproof compound, A. Barnard	171,209
Water wheel and gate, O. S. Hazard	171,223
Water wheel, centrifugal, O. J. Backus	171,256
Weather strip, C. A. Wilhelmi	171,334
Whiffletree hook, E. Maynard	171,235
Wood-bending machine, J. W. Griffiths	171,376
Wrench nut, J. Conway	171,353
Wrench, pipe, J. A. White	171,333
Wringer, J. Brinkerhoff (r)	6,816

DESIGNS PATENTED.

8,852.—GATES, ETC.—F. O. Hanson, Philadelphia, Pa.
8,853.—GATES.—F. O. Hanson, Philadelphia, Pa.
8,854.—CARPET FASTENERS.—M. Kricki, New York city.
8,855.—ORGAN CASE.—J. R. Lomas, New Haven, Conn.
8,856 to 8,859.—OIL CLOTHS.—C. T. Meyer *et al.* Bergen, N. J.
8,860.—CUFF BOXES.—L. Tim, Philadelphia, Pa.
8,861.—STOVES.—N. S. Vedder *et al.*, Troy, N. Y.
8,862.—STOVES.—G. A. Wells *et al.*, Troy, N. Y.
8,863.—COOK RANGES.—G. A. Wells *et al.*, Troy, N. Y.
8,864.—COOK RANGES.—G. A. Wells *et al.*, Troy, N. Y.
8,865.—PLAYING CARDS.—J. D. D. Mortimer, Chicago, Ill.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application or Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,

December 14 to December 18, 1875.

5,500.—J. Challenger, Mitchell, Ont. Harness buckle. Dec. 14, 1875.
5,501.—C. G. C. Simpson, Montreal, P. Q. Extension of 982. Hay press. Dec. 14, 1875.
5,502.—H. W. Woodruff, New York city, U. S. Extension No. 1 of 773. Tanning apparatus, etc. Dec. 14, 1875.
5,503.—H. W. Woodruff, New York city, U. S. Extension No. 2 of 773. Tanning apparatus, etc. Dec. 15, 1875.
5,504.—D. Y. Howell, Toledo, Ohio, U. S., *et al.* Refrigerator. Dec. 16, 1875.
5,505.—D. Y. Howell, Toledo, Ohio, U. S. Box for freezing fish and meats. Dec. 16, 1875.
5,506.—J. W. Harrison, Niles City, Mich., U. S., *et al.* Railway car dumping platform. Dec. 16, 1875.
5,507.—J. Steel, Glasgow, Scotland. Braking and signaling in railway trains, etc. Dec. 16, 1875.
5,508.—A. Le Roy, Syracuse, N. Y., U. S. Folding blind. Dec. 16, 1875.
5,509.—S. F. Humphrey, St. Thomas, Ont. Whiffletrees. Dec. 16, 1875.
5,510.—H. Port, Stapleton, N. Y., U. S. Apparatus for raising water, etc. Dec. 16, 1875.
5,511.—T. Bowmann *et al.*, Fort Erie, Ont. Distance indicator for vehicles. Dec. 16, 1875.
5,512.—G. F. Sawyer, Albion, N. Y., U. S. Stove board. Dec. 16, 1875.
5,513.—G. F. Sawyer, Albion, N. Y., U. S. Coal scuttle. Dec. 16, 1875.
5,514.—L. Blair, Painesville, Ohio, U. S. Fifth wheel for vehicles. Dec. 16, 1875.
5,515.—A. J. Park, Virginia, Miss., U. S. Hame fastener. Dec. 16, 1875.
5,516.—I. Curtis, Urbana, Ill., U. S. Hay rake and loader. Dec. 16, 1875.
5,517.—W. H. Barker, Pella, Iowa, U. S. Adjustable buckle for garments. Dec. 16, 1875.
5,518.—I. N. Herrick, Chicago, Ill., U. S. Soda cask. Dec. 16, 1875.
5,519.—D. T. Welch, St. Louis, Mo., U. S. Lifting jack. Dec. 16, 1875.
5,520.—S. Selden, Erie, Pa., U. S. Dampers for stove pipes. Dec. 16, 1875.
5,521.—T. Gain, Hamilton, Ont. Cutting paper for paper bags. Dec. 16, 1875.
5,522.—A. Chambers, Marylebone Road, England. Signaling apparatus for railways. Dec. 16, 1875.
5,523.—J. Caman, Port Colborne, Ont. Conveying and dumping excavated material. Dec. 16, 1875
5,524.—T. S. E. Dixon *et al.*, Chicago, Ill., U. S. Railway car axle. Dec. 18, 1875.
5,525.—N. W. Wilson *et al.*, Syracuse, N. Y., U. S. Tank can for oils, etc. Dec. 18, 1875.
5,526.—E. Davee *et al.*, Springfield, Ohio, U. S. Dry kiln. Dec. 18, 1875.
5,527.—W. H. Shapley *et al.*, Brantford, Ont. Lamp chimney. Dec. 18, 1875.
5,528.—A. Q. Allis *et al.*, Cleveland, Ohio, U. S. Oil stone. Dec. 18, 1875.

Munn & Co's. Patent Offices.

Established 1846.

The Oldest Agency for Soliciting Patents in the United States.

TWENTY-NINE YEARS' EXPERIENCE.

MORE PATENTS have been secured through this agency, at home and abroad, than through any other in the world.

They employ as their assistants a corps of the most experienced men as examiners, specification writers, and draftsmen that can be found, many of whom have been selected from the ranks of the Patent Office.

SIXTY THOUSAND inventors have availed themselves of Munn & Co.'s services in examining their inventions, and procuring their patents.

MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine inventions confer with inventors, prepare drawings, specifications, and assignments, attend to filing applications in the Patent Office, paying the government fees, and watch each case step by step while pending before the examiner. This is done through their branch office, corner F and 7th streets, Washington. They also prepare and file caveats, procure design patents, trademarks, and reissues, attend to rejected cases (prepared by the inventor or other attorneys), procure copyrights, attend to interferences, give written opinions on matters of infringement, furnish copies of patents, and, in fact, attend to every branch of patent business both in this and in foreign countries.

A special notice is made in the SCIENTIFIC AMERICAN of all inventions patented through this Agency, with the name and residence of the patentee. Patents are often sold, in part or whole, to persons attracted to the invention by such notice.

Patents obtained in Canada, England, France, Belgium, Germany, Russia, Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are granted at prices greatly reduced from former rates. Send for pamphlet pertaining specially to foreign patents, which states the cost, time granted, and the requirements for each country.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet containing the laws and full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful handbook of reference for everybody. Price 25 cents, mailed free. Address

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN
37 Park Row, N. Y.
BRANCH OFFICE—Corner F and 7th Streets Washington, D. C.